CONNECTICUT RIVER FLOOD CONTROL

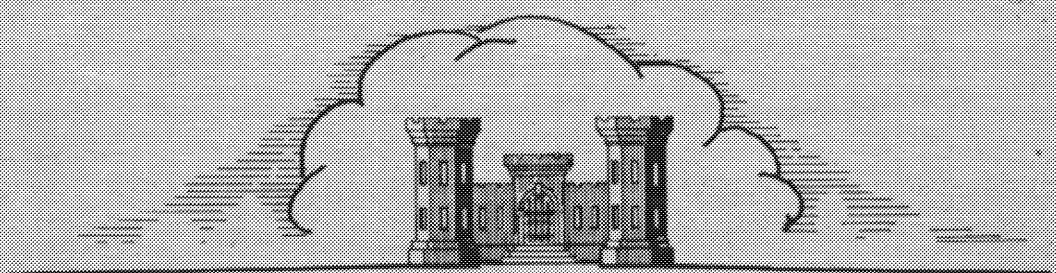
OPERATION AND MAINTENANCE MANUAL

FOR

FLOOD PROTECTION SYSTEM

EAST HARTFORD, CONN.

DIKE AND STOP-LOG STRUCTURE



WAR DEPARTMENT CORPS OF ENGINEERS U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

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OPERATION AND MAINTENANCE MANUAL

FLOOD PROTECTION SYSTEM

EAST HARTFORD, CONNECTICUT

FOREWORD

The successful functioning of a flood protection system is not assured by construction of an adequate system of dikes, walls and pumping plants. If the system is to perform its function it must be carefully maintained during periods of normal river stages and properly operated during flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through failure of a critical element in flood time, caused by deterioration or damage that would have been eliminated by proper maintenance.

Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the best methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may know their responsibilities in maintaining and operating the flood protection system in accordance with the regulations prescribed by the Secretary of War so as to obtain maximum benefits. Maintenance and operation shall be provided in strict accordance with the regulations prescribed by the Secretary of War as amplified by this manual.

OPERATION AND MAINTENANCE MANUAL

FLOOD PROTECTION SYSTEM

EAST HARTFORD, CONNECTICUT

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SECTION I. INTRODUCTION

1-01. AUTHORIZATION. - The flood protection project for East Hartford, Connecticut, was authorized by the Flood Control Act approved June 28, 1938, House Document No. 455, 75th Congress, 2nd session, as modified by Public No. 859, 76th Congress, approved October 15, 1940.

1-02. LOCATION. - The project is located in the Town of East Hartford on the east bank of the Connecticut River fifty-two miles above its mouth.

1-03. DATE OF CONSTRUCTION. - Construction started December 16, 1938 on the first unit and the entire program was completed July 17, 1943.

1-04. DESCRIPTION. - The protection consists of approximately 20,000 feet of earth dike and 750 feet of concrete flood wall along the Connecticut and Hockanum Rivers extending from the high ground near Greene Terrace in the north, to high ground at Brewer Lane and Central Avenue in the south; two stop-log structures; three pumping stations for the disposal of interior drainage; and appurtenant drainage structures and facilities.

1-05. PROTECTION PROVIDED. - The dike system affords protection to all areas subject to floods in the Town of East Hartford. The project grade for dikes and walls was designed to protect against a flood greater than any of record, as modified by an approved plan of twenty reservoirs. The grades at all points are above the maximum stage of the record flood, that of March 1936.

1-06. LOCATION MAP. - See Plate No. V of Appendix "D" for location map.

SECTION II. LOCAL COOPERATION REQUIREMENTS

2-01. FLOOD CONTROL ACTS. - The Flood Control Act approved June 22, 1936 (Public No. 738, 74th Congress) provides, "That hereafter no money appropriated under authority of this act shall be expended on the construction of any project until States, political sub-divisions thereof, or other responsible local agencies have given assurances satisfactory to the Secretary of War that they will:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project.

b. Hold and save the United States free from damages due to the construction works, and

c. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of War."

The Act approved June 28, 1938 and modified October 15, 1940, which provided money and authorization for the flood protection works in East Hartford, Connecticut, stated that the above provisions a, b and c would still apply.

2-02. ASSURANCES. - The Charter of the Town of East Hartford, Connecticut, as adopted by the State Legislature of 1929 and amendments in 1939 empowers the President of the Town Council to furnish assurances to the Secretary of War as required by the Flood Control Act of 1936. Assurances were furnished the Secretary of War December 16, 1938 and were approved January 5, 1939. A copy of these assurances is given in Appendix "B" of this manual.

SECTION III. GENERAL REGULATIONS

3-01. PURPOSE OF THIS MANUAL. - The purpose of this manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on August 9, 1944, and published in the Federal Register on August 17, 1944, a copy of which is bound in the back of this volume as Appendix "A". In executing assurances of local cooperation for the East Hartford project, the town has agreed to maintain and operate the completed works in accordance with those Regulations. The Regulations are intended to cover all local protection projects constructed by the Department throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this manual for maintenance and operation of the East Hartford project are intended to supplement the Regulations to permit obtaining all the benefits and protection against floods for which the project was designed. Failure to maintain and operate the project as required by the Regulations and as detailed herein can cause severe property losses and loss of life and can result in an irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection which it provides.

3-02. GENERAL RULES AND REGULATIONS. - The general rules of the regulations prescribed by the Secretary of War to govern the maintenance and operation of flood control works are given in quotation marks in the following paragraphs and are defined further by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

a. These requirements cannot be overstressed and the town authorities must make adequate provisions for funds, personnel, equipment, and materials to allow for the proper maintenance and operation of the flood protection works.

"(2) The State, political sub-division thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the 'Superintendent' who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all structures and facilities during flood periods of low water, all without cost to the United States."

any public utilities. The town shall furnish the District Engineer as built drawings in duplicate of the completed work.

"(6) It shall be the duty of the superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works."

a. See Paragraph 3-05 of this manual for instructions on submitting reports.

"(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

a. The District Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the town.

"(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made."

a. The town should maintain the facilities and keep them in good repair and not wait for the District Engineer to call matters to their attention. The District Office will advise the town how to make any major repairs to the facilities.

"(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the superintendent's organization during flood periods."

a. The town should formulate plans and negotiate agreements with local organizations and companies, who are operating facilities connected with the protection works, to insure that their activities will be properly coordinated with the superintendent's organization during flood periods.

"(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

a. The flood control committee should familiarize themselves with the contents of the manual. The superintendent should conduct classes to instruct his subordinates in the proper maintenance and operation of the flood protection facilities as outlined in the manual. The town authorities are encouraged to call on the U. S. District Engineer Office for any additional advice or instructions required by them in carrying out the town's obligations for maintaining and operating the flood protection facilities.

3-03. MAINTENANCE. - a. The word "maintenance" as used in this manual, applies to the upkeep, repair and care of the work constructed by the War Department and turned over to the town. Failure to properly maintain the structures will lead to deterioration and possible failure in flood time when there is due need of dependable protection.

b. Satisfactory and dependable operation depends on constant maintenance. The organization which cares for maintenance will be familiar with all parts of the system and will be in a position to use them effectively in time of stress.

c. Maintenance involves regular inspection of the entire system to detect any deterioration or faulty operation that needs repair. This does not mean a casual automobile trip to places easily accessible, but actually walking over every part of the system.

d. In addition to inspection, stop-log structures, and pumping stations require testing at stated intervals to discover the difficulties that may develop or the part that won't work when it should.

e. Each of the major features of your project will be discussed separately with respect to the points that should be watched as developed through the use of similar structures over a long period of years.

3-04. OPERATION. - a. Operation in this manual refers to the actual use of the various features of the protection works when the town is threatened by possible high waters.

b. When danger from high waters is expected it is important that decisions be reached and prompt action taken and that the person in charge has the authority to carry out his decisions.

c. To insure correct operation it is essential that at least one person is familiar with all phases of the flood protection works, who knows when to start pumping stations, install stop-logs, location of gates and valves and when to close them, just what supplies are on hand and necessary transportation of supplies to danger points, and what men and tools can be mobilized for the patrolling and repair work.

d. Arrangements should be made with the United States Weather Bureau Office, Brainard Field, Hartford, Connecticut (telephone number Hartford 2-8116), to keep the town informed on flood predictions. The Weather Bureau Office at Hartford is the official agency for collecting precipitation and runoff data and the preparation of flood forecasts and is responsible for issuance of flood warnings. It receives during impending flood periods, telephoned reports of precipitation and runoff every six hours from selected points in the Connecticut River Basin. From these data Connecticut River stage forecasts for critical locations between White River Junction, Vermont and Hartford, Connecticut are prepared.

e. It will be to the Town's advantage to negotiate agreements with private owners and companies to operate and maintain project features that are directly related to facilities and property of those parties. The Town must remember, however, that the U. S. Engineer Department will look only to the Town for maintenance and operation of the project since that is the body which executed assurances of local cooperation.

3-05. REPORTS. - a. The regulations prescribed by the Secretary of War call for reports to be submitted by the superintendent to the District Engineer, covering inspection, maintenance and operation. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the regulations.

(1) Floods can occur in any month of the year. Spring is the season in which the majority of the floods have occurred. The three greatest floods of record occurred as follows: the highest occurred March 1936, the second highest September 1938 and the third highest November 1927.

b. To assist the superintendent in making his inspections, a series of report forms for the individual features has been prepared. Samples of these forms are given in Appendix "C". The superintendent will have additional copies printed for use in submitting his reports.

c. The semi-annual reports should be submitted, in triplicate, to the District Engineer each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

(1) A description of the maintenance work performed in the preceding six months.

(2) The number and classification of men working on maintenance, regularly and intermittently.

(3) Description of any work performed by contract on the repair or improvement of the project.

(4) Describe what use or operation of the system was made during the period being reported.

(5) Suggestions relative to public cooperation, and comments concerning public sentiment on the protection obtained, are considered pertinent and desirable data for inclusion in the report, but such data are not required.

SECTION IV. DIKES

4-01. **DESCRIPTION.** - The dikes for the protection of the Town of East Hartford are designed on sound engineering principles and are not mere piles of dirt from the handiest sources. They are constructed of free draining river sand with a thick layer of dense impervious earth on the river side extending down to a steel sheet piling cutoff or to an impervious strata to prevent water seeping through the dike, and at the landside toe of the dike a drain is provided to control any seepage that may occur. Both sides of the dike are covered with topsoil to prevent erosion and on the riverside where scour from the Connecticut or Hockanum Rivers may occur riprap is provided.

4-02. **MAINTENANCE.** - a. The regulations prescribed by the Secretary of War under paragraph 208.10 (b) (1) give rules for the maintenance of levees. These rules apply just as well to earth dikes, and are quoted here to avoid cross references to the regulations. Following this, a few of the points that apply particularly to the Town of East Hartford will be discussed.

"Levees - (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damages caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and further, to be certain that:

(i) No unusual settlement, sloughing or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

b. Any unusual settlement, sloughing or caving should be corrected to restore the original dike grades. No major repair work shall be made without prior approval of the District Engineer in order that such repairs that may be necessary will not adversely affect the functioning of the protective facilities.

c. Drains at the landside toe of the dikes are provided as an outlet for seepage through the dike during high water to prevent saturation of the landside slope and the resultant sloughing.

(1) The toe drain north of the railroad is constructed as part of the landside toe of the dike and discharges into an open drainage ditch which also drains the area back of the dike. It is of vital importance to the stability of the dike that the drainage ditch be kept open.

(2) The remainder of the dike toe drains are inside the dike toe and discharge into collector drains through laterals. The collector drain shall be inspected periodically and any silt affecting its proper functioning removed.

d. The grassed slopes should be cut regularly to promote good turf and not allowed to go to hay. The grass should be cut back when it reaches a height of about 8 inches to about 4 inches.

e. When sections of the dike require reestablishment of turf, seeding operations should be started at the earliest practicable date in the spring to secure the greatest possible protection against erosion. Areas requiring seeding shall be dressed to fill gullies, and irregularities in the surface. The surface should then be raked or harrowed parallel to the contour of the dike (never up and down) to a depth of three-quarters of an inch. After the seed is sown the surface shall be lightly raked with iron rakes and all surfaces lightly rolled. The University of Connecticut or a recognized agronomist should be contacted for the purpose of analyzing the soil to determine if lime is needed and what fertilizer or seed mixture is best suited to the local conditions.

4-03. OPERATION. - a. The regulations prescribed by the Secretary of War under paragraph 208.10 (b) (2) give rules for the operation of levees. These rules apply just as well to earth dikes and are quoted here to avoid cross reference to the regulations.

"Levees - (1) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

b. Operation as referred to the use of dikes may be at a time of moderate high water such as a spring freshet or may be when unusual conditions indicate the possibility of dangerous flood heights. A map and table in a later section will show elevations at which the various parts of the system should be operated such as: Checking flap valves and check valves, closing valves, installing stop-logs, manning pumping stations and patrolling dikes. Floods on the Connecticut River do not give much time in which to make extensive preparations, therefore prompt action in starting work is of utmost importance.

c. Operation of the protective system depends on the river stage at the various items. The patrolling of the dikes depends on the depth of water against the riverside slope and for convenience will be referred to river stage as recorded by the United States Weather Bureau at Memorial Bridge.

(1) Only occasional patrolling of the dikes should be necessary until a river stage of 20.0 feet is reached at which time a thorough examination should be made at intervals of not more than four hours. As the water rises, the interval between examinations should be shortened until, at major flood stages, the dikes are examined at hourly intervals, with special watchmen being assigned if necessary at places which might become dangerous.

(2) Patrolmen should be thoroughly instructed as to their duties, what they are to watch out for and the exact limits of their beat. On each journey of inspection they should carefully examine both slopes of the dike for: seepage or wetness on landside slope, sand boils on landside of dike, wave wash or scouring on riverside slope, and that no slides or sloughs are developing.

(3) Unauthorized traffic on the dikes should not be allowed at any time, and patrolmen should be instructed to keep people off the dikes unless they can show passes or credentials authorizing their presence.

(4) Plans should be made for a system of one-way traffic on the dikes in time of flood for bringing in supplies that may be needed. In the event that materials are urgently needed at a point, trucks can be routed both ways and after depositing their loads driven down the landside slope.

4-04. EMERGENCY REPAIR METHODS. - a. Scours. - Careful watch should be maintained over stretches of the dike where scouring is likely to occur, such as slopes not protected by riprap, blanketed foreshores, and particularly angles in the dike alignment where it is subjected to heavy currents, even though the slope is protected by riprap. If any indication of scouring is observed, soundings should be taken to observe the amount and progress of the scour. Sandbagging or dumped rock will generally afford the most practicable means of combatting this condition. The open ends of sandbags, so used, must be sewed or tied after filling with earth.

b. Wave Wash. - Dikes may be subjected to wave wash on broad reaches of water even though the direct action of high wind is impeded by natural barriers such as trees. Well sodded slopes will usually withstand waves from a storm of about an hour's duration without serious damage. An attack over a longer period may become serious and the slopes should be protected by sacking or equivalent protection. Extent of washes can be observed by wading along the attacked slope. Sandbags should be placed in the erosions in as effective a manner as possible, carrying the protection well above the action of the waves. Sandbags used for this purpose require only about one-half cubic foot of material and should be sewed or tied. The aim is to obtain a maximum of coverage with only sufficient weight to hold the sack in place.

c. Sand Boils. - (1) General. A sand boil is the result of a transfer of pressure head and seepage from the river through a pervious stratum near or at the surface to the landside of the levee.

This seepage under pressure tends to push its way to the surface and actually floats the material through which it flows. Provided the weight of the relatively impervious soil layer overlying the pervious stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure, no harmful effect results. When the soil stratum overlying the pervious layer is insufficient to counterbalance the upward pressure or when no such stratum exists, boils break through the surface on the landside wherever these weaknesses are present. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

(2) Effects of Sand Boils. - Sand boils can produce three distinctly different effects on the levee, depending upon the condition of flow under the levee. These three effects are illustrated by the following figures. In Figure 1, Plate IIIA, Appendix "D" the seepage flow develops a definite pipe or tube under the levee. This breaks out at the landside toe in the form of one or more large sand boils. Unless checked, this flow causes a cavern to be developed under the levee, resulting in subsidence of the levee and subsequent overtopping. This case can be most easily recognized by slumping of the levee crown. Figure 2 Plate IIIA, Appendix "D" illustrates the case where seepage flows under pressure under the levee without following a defined path, as was the case above. This flow results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the slope, resulting in a sloughing of the slope. Evidence of this type of failure is found in undercutting and ravelling at the landside toe. Figure 3 Plate IIIA, Appendix "D" shows a third type of effect of a sand boil. In this case, numerous small boils, many of which are scarcely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, the consequence of the group of boils is to cause floatation of the soil, thereby reducing the shearing strength of the material at the toe, where maximum shearing stress occurs, to such an extent that failure of the slope through sliding results.

(3) General Instructions for Handling Sand Boils. - All sand boils should be watched closely. All boils should be marked conspicuously with flagging so that patrols can locate them without difficulty and observe changes in their condition. A sand boil which discharges clear water in a steady flow is usually not dangerous to the safety of the levee. The only action necessary in this case is to drain the excess water off to prevent it from standing near the levee. However, if the flow of water increases, and the sand boil begins to discharge material, corrective action should be undertaken immediately.

(4) Method of Treatment. - (a) The accepted method of treating sand boils is to construct a ring of sand bags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt. The accepted method of ringing a sand boil is as follows:

1. The entire base of the sack ring is cleared of debris, in order to provide a watertight bond between the natural ground and the sack ring.

2. The sacks are then laid in a ring around the boil, with joints staggered, and with loose earth between all sacks.

3. The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

4. A "V" shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off the water.

(b) Actual conditions at each sand boil will determine the exact dimensions of the ring. The diameter and height of the ring depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

1. The base width should be no less than 1-1/2 times the contemplated height.

2. It is well to include weak ground near the boil within the ring, thereby preventing a break through later.

3. The ring should be of sufficient size to permit sacking operations to keep ahead of the flow of water.

(c) Where many boils are found to exist in a given area, a ring levee of sand bags should be constructed around the entire area and, if necessary, water should be pumped into the area to provide sufficient weight to counterbalance the upward pressure.

d. Sloughs. - During prolonged high water stages, seeping and sloughing conditions on the back slopes may occur. Such conditions should be observed closely as to progress of seepage up the back slope and the amount of material that is being carried by the water. If the seep velocity becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering should be placed on the seeping area, beginning well out from the toe and progressing up the slope. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be covered with brush, straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit the seep water to get away while serving as a filter to prevent loss of earth from the dike. After the covering is placed, close observation should be maintained and additional layers of sandbags placed on the previous one until the velocity of the seepage is reduced to a point at which the amount of material carried is negligible.

e. Raising existing earth dikes. - In emergency, time and other conditions permitting, the grade of a dike can be reasonably safely raised by at least three feet. The method most commonly used for this purpose is outlined in the following paragraphs and illustrated by exhibits attached.

(1) Sandbag topping. - The sack ordinarily used for topping an earth dike is such as is used for grains or other feeds and holds 100 pounds of grain. Smaller sacks may be used if feed sacks are not available. Grain sacks, filled with about one cubic foot of earth, weighing about 100 pounds, will provide a unit about 6 inches high, one foot wide and two feet in length.

The sacks may be filled at the source of material and hauled to the dike or filled from stockpile or borrow areas at the dike, conditions determining the method employed. The same is true of filling; i.e., power or hand methods.

The open end of the sacks should always face upstream or toward the riverside of the dike and need not be sewed or tied. When the sack faces the river the loose end should be folded under and when facing upstream the loose end covered by the succeeding sack.

The front line of sandbags in the first layer should be laid parallel to the dike center line and remaining bags at right angles to the center line. The sandbags in the second layer are all laid at right angles to the center line, the third row similar to the first, etc., as shown on attached sketch Plate No. 1, Appendix "D". All sacks should be lapped about one-third each way and well mauled or tramped into place. The sacks should be filled to two-thirds their capacity when flattened out to facilitate proper placing and prevent bursting the sack when mauled or tramped into place.

Plate No. 1, Appendix "D" illustrates the progressive method of increasing the dike height and gives an approximation of the number of sacks required for dikes of various heights.

A crew of 50 men should fill, carry and place approximately 1500 sacks per 8-hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site.

SECTION V. FLOOD WALLS

5-01. DESCRIPTION. - The flood walls are the reinforced concrete cantilever type, consisting of a vertical wall, or stem, on a base with a key and a steel sheet piling cutoff wall. Drains are provided on the landside of the wall to collect seepage water and are tied into the collector system. The walls were then backfilled to natural ground to provide surface drainage.

5-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of flood walls.

"Periodic inspections shall be made by the Superintendent to be certain that:

(1) No seepage, saturated areas, or sand boils are occurring;

(2) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(3) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(4) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(5) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(6) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(7) No bank caving conditions exist riverward of the wall which might endanger its stability;

(8) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice."

b. The expansion joint material serves to protect the copper water stop against damage. When the expansion joint material

has deteriorated to the point where it no longer serves its purpose the loose material should be cleaned out, care being exercised not to injure the copper seal, and the joint poured full with asphalt.

5-03. OPERATION. - a. The following quotations from the regulations govern the operation of walls.

"Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall."

b. The recommendations made in paragraph 4-03 b for dikes apply equally as well for the operation of the walls.

5-04. EMERGENCY REPAIR METHODS. - a. Sand boils. - See Section IV, paragraph 4-04 c for a description and treatment of sand boils.

b. Monolith joints. - If vertical monolith joints have appreciable leakage, they can be controlled by dumping cinders, sand or other such material on the riverside of the wall and the dumped material will be carried into the joint by the water and plug the leak.

c. Raising grade of wall. - In the event there is damage of the walls being overtopped by the flood, they can be raised reasonably safe to three feet above their present grade. One tier of sandbags placed on top of the wall will raise the grade approximately six inches and afford protection against wave action. If the wall grades are to be raised beyond six inches, it can be best accomplished by erecting a wooden extension such as shown on Plate IV of Appendix "D".

SECTION VI. CLOSURE STRUCTURES

6-01. DESCRIPTION. - a. The closure structures are of two types, the bulkhead door type, and the stop-log type, and are provided to permit passage through the flood protection system during non-flood periods. A brief description of each closure starting at Stop-log No. 1 at the upper end of the protection system is given (see Plate No. V of Appendix "D"). All sill elevations are on U. S. Weather Bureau Datum.

(1) Stop-log No. 1. - This structure is a railroad stop-log for a single track line of the New York, New Haven and Hartford Railroad to Willimantic, Connecticut, and railroad roundhouse in East Hartford, Connecticut, having a clear opening of 19 feet and sill elevation of 33.5. In closing this opening, it is not necessary to remove the rails as the lower stop-logs are formed to fit around them.

(2) Bulkhead door. - This opening is located in the flood wall at the Shell Oil Company, having a clear opening of 3-1/2 feet by 7 feet and sill elevation of 19.05. This opening provides access through the wall to the Shell Oil Company loading dock.

(3) Stop-log No. 2. - This structure is a highway stop-log for four lanes of concrete pavement with a dividing strip having a single track railroad spur of the New York, New Haven and Hartford Railroad to the United Aircraft Corporation. This structure has a clear opening of 80 feet, 1 inch and a sill elevation of 29.05 at center line of east lane, 29.2 at center line of west lane, and 29.35 at center line of railroad tracks.

6-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of closure structures.

"Closure structures for traffic openings shall be inspected by the Superintendent every 90 days to be certain that:

(1) no parts are missing;

(2) Metal parts are adequately covered with paint;

(3) All movable parts are in satisfactory working order;

(4) Proper closure can be made promptly when necessary;

(5) Sufficient materials are on hand for the erection of sandbag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once every year, alternating the structures chosen so that each gate will be erected at least once in every 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sandbag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately."

b. Frequent examinations should be made by the Superintendent of the Southern New England Telephone Company manhole on the riverside of the main street stop-log to be certain that the rubber stop plugs around the cables have not deteriorated or been removed.

6-03. OPERATION. - a. The following quotations from the regulations govern the operation of closure structures.

"Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation & Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structure or to discharge passengers or cargo over them."

b. The location of these structures is indicated on Plate No. V of Appendix "D", which also shows the gage reading (United States Weather Bureau) at which the openings should be closed to prevent flooding of the area back of the openings. Public and private parties whose passage through the closure structures is affected by the stopping of the gap should be notified of the intended closing in sufficient time to permit them to perform the necessary evacuation and protection of the public safety. Determination of the time at which any closure erection should be started must be based upon the rate of river rise and time required for installation. The following table shows the estimated time necessary for a trained crew equipped with the necessary tools, parts and material at the site to completely install the closures:

Closure	Size of Crew	Time Required
Stop-log No. 1 - Railroad	16 men	3 hours
Bulkhead Door - Shell Oil Co.	1 man	1/2 hour
Stop-log No. 2 - Highway	16 men	8 hours

The above estimated figures are based on hand labor and using two sets of double block and tackle for hoisting the logs into place.

c. After the stop-log timbers are in place, the openings where the rails are not removed shall be plugged with sandbags and sufficient ballast shall be removed to assure a satisfactory seal. The placing of canvas or sisalcraft paper on the riverside face of the stop-logs will prevent undue leakage of water through the cracks between the timbers with two tiers of sandbags at the bottom to securely anchor the canvas and seal the joint between the first log and the sill. It is not necessary to sandbag behind the stop-log as structural grade timbers are provided capable of withstanding the pressure. The top timbers in the closure should be wedged in place to prevent their tendency to float.

(1) Ample time should be allowed to erect the closures and due allowance must be made for the delays in operation occasioned by inexperienced help and other contingencies. The height of the predicted flood may eliminate a complete closure; however, the intial closing should allow at least a three-foot freeboard.

(2) Care should be exercised to avoid removal of stop-logs during a temporary recession of flood waters which might be followed immediately by a second crest. When all danger from the flood has passed remove the timbers and removable supports, clean them, repair any damage, and return all parts to the respective storage sheds at the site.

SECTION VII. UTILITIES THROUGH THE PROTECTION SYSTEM

7-01. DESCRIPTION. - a. In addition to pumping station conduits passing through the flood protection system, there are a number of public utilities such as gas, water and oil lines that were present and were incorporated in the system. The utilities are listed below for reference and are shown on Plates of Appendix "D".

Location	Description	F.L. Elev. (U.S.W.B.)
Sta. 52+40±	6" Oil line	10.55 at impervious blanket
" 145+54	10" Water line	18.0± at center line of wall
" 146+48.2	2-1/2" Oil line - Valve on end	15.54 at center line of wall
" 146+49.3	" " " " " "	15.54 " " " " "
" 147+05.0	8" Oil line - capped	16.3 " " " " "
" 147+06.3	6" Oil line - capped	16.3 " " " " "
" 147+16.9	6" Oil line - To unloading dock	16.3 " " " " "
" 147+17.7	1" " " " " "	16.3 " " " " "
" 147+18.4	4" " " " " "	16.3 " " " " "
" 147+19.6	6" " " " " "	16.3 " " " " "
" 147+20.9	4" " " " " "	16.3 " " " " "
" 147+22.4	8" " " " " "	16.3 " " " " "
" 147+23.7	6" " " " " "	16.3 " " " " "
" 192+00	6" Oil line	8.0 at impervious blanket
" 194+25	30" Sewer	6.98 at landside valve chamber
" 194+45	30" Sewer (Future Const.)	7.04 at landside temp. plug
" 212+99	4" Water line	25.89 at center line of dike
" 213+05.15	20" Water main	21.22 at center line of dike
" 213+22.15	S.N.E. Tel. Co. Manhole	18.82 floor elevation
" 213+48.6	8" Steel gas line	20.82 at center line of dike
" 213+80.15	20" water main	21.22 at center line of dike

7-02. MAINTENANCE. - a. The utilities passing through the protection system are constructed with seals to prevent leakage along the pipes. The majority of the utilities are oil, gas and water lines that are continuous through lines and are not operated by companies or plants adjacent to the protection works. Alongside of the operating sewer at Station 194+25 is a 30-inch line for future construction that is provided with plugs at both ends.

b. Frequent examinations should be made by the Superintendent of the Southern New England Telephone Company manhole on the riverside of the main street stop-log to be certain that the rubber stop plugs around the cables have not deteriorated or been removed.

7-03. OPERATION. - The utilities through the protection system do not require special attention during high water; however, they should be examined during patrolling operations to be certain that no seepage is occurring along the utility line.

SECTION VIII. PUMPING PLANTS

8-01. DESCRIPTION. - The East Hartford Flood Control System has three pumping stations to pump sewage and storm water from the area behind the dike into the Connecticut River at high water stages.

a. The Cherry Street Pumping Station has two 16-inch gasoline-engine-driven volute pumps. A single phase 230/115 volt power supply furnishes electricity for lighting, a sump pump, and a battery charger.

b. The Pitkin Street Pumping Station has two 20-inch gasoline-engine-driven volute pumps. A single phase 230/115 volt power supply furnishes electricity for lighting, a sump pump, and a battery charger.

c. The Meadow Hill Pumping Station has four 30-inch gasoline-engine-driven propeller pumps for pumping storm water, and a 20-inch variable-speed electrically-driven volute pump for pumping sewage. A 100 K.W. gasoline-engine electric generator is provided to furnish electricity for the sewage pump, lighting, and all station auxiliaries in the event of failure of the utility's power supply.

A storage pond is provided in conjunction with the pumping station to allow an inflow of storm water greater than the pumping capacity of the station to be stored without damage to the protected area. The use of the storage pond allows the capacity of the pumping equipment to be less than it would have been without the storage pond. The pumping capacity is adequate to keep the protected area from inundation at the maximum design inflow providing the storage pond is pumped down to its low point at the start of the peak runoff. In view of this, it is necessary for the Town of East Hartford to keep the storage pond at a minimum at all times and not use the storage pond merely for flexibility of operation.

8-02. MAINTENANCE. - a. The following quotations from the regulations govern the maintenance of pumping stations:

"Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled

electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable."

b. General. - Proper maintenance of the pumping station requires periodic operation of all equipment at frequent intervals to keep equipment in good working order and all parts well lubricated and free from corrosion. Periodic operation of equipment also permits an inspection of the functioning of all equipment so that defective parts may be properly replaced or repaired before their use is required for pumping operations. Inasmuch as mechanical and electrical equipment deteriorates more rapidly from idleness than from continued use, a thorough and complete maintenance routine is well justified.

The heating systems should be utilized during the colder months to prevent freezing of water in pipes and cooling water jackets, and also to prevent condensation of moisture on equipment within the building.

c. Gasoline engines. - Once a week, all gasoline engines should be run for two hours. The operation of the engines for this length of time is necessary to get the crankcase oil warmed up sufficiently to evaporate any gasoline that entered the crankcase during starting and to evaporate any moisture that is in the crankcase oil due to condensation. During this period of operation the functioning of the engine and accessories should be checked for proper performance. The following are the principal items to be checked.

(1) Water temperature should be maintained at 160 degrees Fahrenheit.

(2) Ignition - open all ignition switches but one and test each ignition circuit separately in this manner.

(3) Heating of cylinder blocks - place hand on different portion of each block. Temperatures should be approximately equal.

The gasoline electric generator should be run at full speed during the maintenance routine. The pump engines should be run at full speed after disconnecting the engines from the gear units by disassembling the flexible couplings. Pumps should never be run for more than very short periods of time without water in the casing or around the impeller as the pumps require water for lubrication of their rings.

The oil in the engines should be changed twice a year or after every 100 hours of operation, whichever is more frequent. At the time of oil changing the oil filters should be removed and cleaned.

The drain valves at the base of the vertical exhaust pipes should be opened once a month at a time the engines are in operation to allow the condensate collected in the pipes to drain before it collects sufficiently to back up into the exhaust manifolds and into the cylinders.

Once a year the flexible coupling between the engine and the gear unit should be disassembled and the alignment, both angular and parallel, of the two coupling halves checked with a parallel bar and feeler gauges. If misalignment is present, either angularly or in a parallel direction and exceeds .010 inch, the gear unit should be realigned with the engine.

d. Pumps. - (1) No maintenance of the propeller pumps is ordinarily required except that necessary to keep them painted and lubricated. An occasional inspection should be made of the impellers to see that they are free from debris. Once a year the clearances of each impeller should be checked by running a feeler gauge between each impeller blade and the pump casing. At the point of minimum clearance of each impeller the gap should be between .020 and .040 inch. If the minimum clearance is found to be less than .020 inch the impeller should be raised by adjusting the thrust nut on top of the pump shaft in the upper part of the gear unit.

(2) The volute pump at the Meadow Hill Pumping Station should be turned electrically once a week by energizing the motor for approximately three seconds. This will allow the motor and pump to come up to approximately half speed and thus spread a film of oil over the bearings. The pumps in the Cherry Street and Pumping Stations should be connected to the engines once a month and the pumps run at one-half rated speed for fifteen seconds. Volute pumps should never be run for more than thirty seconds without water in the casing because of the wearing rings depend on water for lubrication.

(3) The sump pumps should be started once a week and run for three seconds.

e. Switchboard, wiring and motors. - The switchboard should be completely checked once a year. Insulators should be cleaned, all lugs and connections checked and tightened, and ground connections checked for continuity. The insulation resistance of all circuits and motors should be measured once a year. The result of each of these measurements should be plotted on a chart with insulation resistance as the abscissa and time in years as the ordinate. This will show the change in condition of circuits and motors from year to year and will allow remedial measures to be taken before breakdown occurs.

Rings and commutators should be cleaned yearly and motors and the generator blown out with dry compressed air at similar intervals.

f. Gear units. - The gear units should show a flow of oil through the sight glass at all times while in operation. If the flow is not present the unit should be immediately shut down and the cause of the lack of oil corrected.

The oil in the gear units should be changed every two years. Every six months the cover plates on the side of the gear unit should be removed and the condition of the teeth inspected for proper tooth contact.

A pair of shear pins are provided in the top of each gear unit to allow the high speed shaft to run free of the pump shaft in the event debris clogs the impeller. Spare shear pins should be provided to replace any broken ones.

g. Gates and valves. - All gates and valves should be raised or lowered a short distance weekly. Electrically-operated gates should be moved through a complete closing and opening cycle monthly. At this same monthly interval the sills of the gates should be cleaned of silt and debris.

There are on each electrically-operated gate hoist some resistors located within the motor control panel in series with the indicating lights. Inasmuch as these resistors will emit a little heat when the indicating lights are on, it is recommended that at all times the feeders to the electrically-operated gate valves and gates be kept energized and the indicating lights kept lighted so that the resistors will provide a little heat to combat any moisture that enters the control panel.

The limit switches should be inspected once a year, contacts cleaned, and the limit switch oil changed with fresh transfer oil.

The gate stems should be kept cleaned and covered with a thin film of grease to protect them. The seating of the gravity conduit sluice gate should be checked yearly to see that the gate is being seated firmly by the wedges and that no wedges are broken or fouled with debris. It may be necessary to occasionally readjust the wedges to effect a tight gate closure.

h. Storage batteries. - The storage batteries should be kept properly filled with distilled water. Water from the municipal system should not be used. The batteries should be kept fully charged at all times. The specific gravity of the batteries at full charge is between 1.210 and 1.225.

It is important to keep the tops of the batteries clean because a layer of foreign material, such as dirt, grease or moisture, will allow small currents to flow between terminals thus discharging the battery constantly.

i. Fire protection equipment. - All carbon dioxide cylinders should be weighed every six months to determine their condition. The gross weight of each cylinder, fully charged, is stamped on the cylinder. The cylinders should be promptly recharged if the weight is less than the weight stamped on the cylinder.

j. Heating system. - The boiler should be cleaned once a year by opening the mud valves at the base of the boiler and drawing off the sediment. Each fall before the heating system is put into operation the oil burner and controls should be thoroughly checked by a competent oil burner mechanic.

k. Painting. - All metal surfaces not otherwise protected must be kept painted to maintain the metal in good condition. The exterior metal work such as pipe railings, trash racks, cover plates, exterior gate hoist, flap valves, will require frequent painting because of exposure to the weather.

The silencers should be kept painted with a high temperature paint.

The metal surfaces in the propeller pump sump will require frequent painting due to the severe moisture conditions. Although the pump columns are constructed from corrosion-resisting steel, the bolts and nuts on the pumps are cold rolled steel and must be kept protected.

The sluice gates must be painted occasionally to prevent the cast iron from deteriorating.

l. Propeller pump sump. - After each period of high water during which the propeller pumps have been used, the sump should be emptied of water and the sump cleaned of all silt and debris. Most of the deposit on the floor can be washed into the sump pump sump by a stream of water from a hose and then removed with the sump pump. Any large debris, sticks, stones, rags, etc., should be removed manually. After the floor has been cleaned the sump pump sump should be cleaned of all foreign matter.

m. Due to the horizontal position of the silencers at the Meadow Hill Pumping Station, moisture will collect within the silencers and corrode the inside. It is suggested that, if possible, the drain plugs on these silencers be removed and the drain holes left open. The small increase in noise due to these open holes will not be noticeable from the ground.

n. Anchor bolts. - At yearly intervals all anchor bolts, piping bolts, Dresser coupling bolts, pump assembly bolts, and all parts that might change position shall be checked for tightness and tightened if necessary.

o. Draining water in pumping station. - If, due to the failure of the heating system in cold weather, it becomes necessary to drain all water in the Meadow Hill Pumping Station, the following steps should be taken:

(1) Open drain valve at low point in water line in 20-inch pump room.

(2) Open gate valves and quick-opening valves in water supply lines at all engines.

(3) Open all petcocks on engines.

(4) Remove plug in bottom of flexible water-cooled exhausts.

(5) Drain sanitary fixtures and open all traps.

(6) Drain emergency water pump by removing plug in bottom of pump casing.

(7) Drain filter located in 20-inch pump room in water line to emergency water pump.

(8) Drain boiler and heating system.

p. Lubrication. - The two main requirements to keep equipment well lubricated are to operate equipment frequently to spread a film of lubricant over the bearing surfaces, and secondly to use proper kinds and grades of good lubricants. As greases cake and harden time, bearings should be disassembled periodically, cleaned, and repacked with fresh grease. Cup greases should not be used on the equipment for any purpose because most cup greases have water as a binder. This moisture in contact with idle metal surfaces will corrode them in time.

The Keystone Velox No. 3 grease has been suggested by the pump manufacturer because it is a grease that is highly resistant to water and will not harden or cake in long lines. The grease selected for anti-friction bearings should be a special bearing grease designed to assure instantaneous lubricating activity and low starting and running torque.

The following is a tabulation of the types and grades of lubricants to be used on the equipment in the pumping station and the intervals between their application and change.

(1) Engines - pumps and generator. - A good grade of automotive oil for crankcase use, SAE - 30 should be used. Change oil and clean oil filters every six months, preferably just before pumping operations in the spring and again in the fall.

After every thirty hours of operation a few drops of light bearing oil should be applied to the oil cups, and the grease cups turned down or refilled with a light pressure grease.

(2) Gear units. - A good grade of automotive oil, SAE - 50 should be used. Change oil and clean oil filters every two years.

(3) Propeller pumps. - The manufacturer recommends the use of Keystone Velox No. 3 grease for the lower bearings of these pumps. Use a high pressure grease gun and apply after every ten hours of operation.

The Madison Kipp lubricators should be kept filled with an automotive oil, SAE - 20 and adjusted to feed approximately 10 drops a minute to the pump bearings.

(4) Volute pump. - The manufacturer recommends the use of Keystone Velox No. 3 grease for the shaft packing gland on the pump. The cup should be turned down a little after every few hours of operation and refilled when empty.

The grease cups on the pump bearings and the steady bearing should be filled with a light ball bearing grease. The grease cups on these bearings should be turned down, but only a little, after every fifty hours of operation. Anti-friction bearings will fail just as rapidly because of too much grease as from too little.

The two bearings on the volute pump and the steady bearing should be disassembled every three years, cleaned, and covered with a film of grease.

(5) Motor and generator bearings. - A good bearing oil, SAE - 20 should be used in the sleeve bearings of the generator, the bearings of the volute pump motor, and the bearings of the small motors throughout the pumping stations. The generator bearings and volute pump motor bearings should be drained, flushed out with kerosene, and refilled every two years.

(6) Electrically-operated gate hoists. - Every three months the electrically-operated hoists should be greased with a good pressure grease. Once a year the motor bearings should be greased with a light ball bearing grease. Care should be exercised in greasing the motor because an excess of grease is liable to run into the motor and damage the motor windings.

(7) Crane. - The grease fittings on the crane should be lubricated once a year with a pressure grease.

(8) Sump pump. - Once a month grease pump fittings with Keystone Velox No. 3 grease, using a high pressure grease gun.

(9) Flexible couplings. - The Morse Chain flexible couplings used between the pump engines and the gear units take a medium weight grease.

q. Manufacturers' drawings and recommendations. - (1) The U. S. Engineer Office has furnished the Town of East Hartford a complete set of manufacturers' drawings pertaining to the mechanical and electrical equipment in the pumping station. These drawings should be kept in good condition and available for reference at all times. If, for any reason, the drawings become damaged or lost they should be replaced. The manufacturers will replace drawings for a nominal cost.

(2) There follows a list of manufacturers' publications which should be followed for operation and maintenance.

(a) Meadow Hill Engines. - Instruction Book and Parts List.

Model 6RI
6 Cylinder 6 x 7

Climax Engineering Company
Clinton, Iowa

(b) Generator. - Instructions GEH - 709G Large Horizontal Motors and Generators - D.C. and Synchronous A.C. - Machines.

Instructions GEH - 67E Direct - Connected Exciters.

General Electric Company.

(c) Volute pump. - Instructions for Installation and Operation - Centrifugal Pumps. - Publication No. W-300-E1B.

Worthington Pump and Machinery Corporation.

(d) Switchboard. - Instruction Book for Installation, Operation and Maintenance of Switchboards. Publication No. I. B. 5201-F.

Westinghouse Electric & Manufacturing Co.

(e) Storage batteries. - Instructions for Installing and Operating Exide Batteries - Low Gravity Types in Rubber.

The Electric Storage Battery Co.
Philadelphia, Pa.

(f) Electrically-operated gate hoists. -

Installation and Care of Chapman Motor Units.
Setting and Care of Chapman Limit Switches.

Chapman Valve Mfg. Co.
Indian Orchard, Mass.

8-03. OPERATION. - a. The following quotations from the regulations govern the operation of pumping stations:

"Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturer's instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood."

b. Cherry Street Pumping Station. - (1) General. - The first steps to be taken to put the Cherry Street Pumping Station in operation is to close the gate valve in the sewer discharge line and open the sluice gate on the intake to the pumping station.

(2) Pumps. - The following steps should be taken in starting and operating one of the pumping units:

(a) Open test gate valve on top of pump discharge to make sure pump is primed. Water will flow out of this valve if properly primed. If air is discharged instead of water keep valve open until all air is discharged. The pumps should never be run dry for more than thirty seconds. The pumps are built with bronze wearing rings - one on the impeller and one on the casing - having very small clearances. The wearing rings require water for lubrication and prolonged pumping without water in the casing could result in the wearing rings "freezing" together, thus requiring extensive repair work.

(b) Check flexible coupling beteen engine and gear unit to see that it is properly assembled and filled with grease.

(c) Check cooling water system for level of water.

(d) Check lubricating oil level.

(e) Open louvers in building wall for engine for exhaust.

(f) Pump up gasoline by use of hand gasoline pump.

(g) Set throttle approximately one-half inch from fully closed position.

(h) Close both ignition switches.

(i) Depress low-oil-pressure cut-out switch with foot and hold down until after engine has started and oil pressure has built up to 10 pounds.

(j) Press "Start" button and choke as much as necessary to start engine and maintain engine speed at an even firing rate.

(k) Do not overchoke as this results in washing the lubricating oil from the cylinder walls and dilution of the crankcase oil.

(l) Set throttle to maintain an engine speed of 600 R.P.M. and allow engine to warm up for five minutes.

(m) Check oil pressure gage on gear unit. Gage should show a positive pressure. If no pressure is indicated shut engine down and determine cause of lack of oil pressure.

(n) Check pump again to make sure it is properly primed. Allow all air to escape.

(o) After the five minute warm-up period move throttle to fully open position. Governor will maintain engine speed at 1200 R.P.M.

(p) Keep at least one door open during operation of the engines to furnish air to make up for that being exhausted from the building by the engine radiator fans.

(3) Battery charger. - The battery charger should be used to maintain the batteries at a full charge at all times. A switch is provided on each engine panelboard in the battery charging circuit to allow either engine battery to be charged separately or both at once as desired. The output of the battery charger may be varied from 0 to 24 amperes as needed.

(4) Sump pump. - The sump pump is controlled by the starter on the engine room wall beside the electric panelboard.

c. Pitkin Street Pumping Station. - The Pitkin Street Pumping Station is similar, although having a greater pumping capacity, to the Cherry Street Pumping Station. The operation of all equipment is the same in both pumping stations.

d. Meadow Hill Pumping Station. - (1) Switchboard. - The switchboard controls the distribution of electric energy for power and lighting throughout the pumping station. A service switch is provided in the boiler room to de-energize the switchboard.

(a) Feeders from switchboard. - To energize any of the lighting or power feeders throughout the pumping station, close the main circuit breaker marked "Incoming Line" and read the voltage of the incoming line. The voltmeter may be read by inserting the voltmeter switch handle in the voltmeter switch tapped from the incoming line and turning the handle to each of the three positions on the right-hand side of the switch. The voltage as indicated on the voltmeter should be approximately 230 volts on each of the three phases. If these readings are obtained the circuit breakers on the right-hand panel may be closed, thus energizing the various feeders throughout the pumping station.

(b) Energize switchboard. - If a reading of approximately 230 volts is not obtained on each of the three phases, an interruption of power from the Power Company's source is indicated and the gasoline-electric-driven generator must be used. To energize the switchboard from the generator the operator should open the main circuit breaker on the Incoming Power Line and close the main circuit breaker on the Generator Feeder. These two main circuit breakers are mechanically interlocked so that not more than one circuit breaker can be in the closed position at any time.

(c) Voltage regulator. - The voltage regulator for the generator is a Westinghouse "Silverstat" and is mounted within the

switchboard. The operation of it is automatic when properly adjusted. The voltage regulator operates upon changes of generator voltage to vary resistance in the exciter shunt field circuit thus holding the voltage of the generator constant.

The large Exciter Field Rheostat on the switchboard has been set at the proper position for the operation of the voltage regulator and should be kept in this position. The proper position of the Exciter Field Rheostat is indicated by a mark on the front of the switchboard.

Any adjustment of the generator voltage should always be made by the small knob on the switchboard marked "Voltage Adjusting Rheostat." This should be set so that the voltage of the generator as indicated on the switchboard is 230 volts.

If the voltage regulator fails to operate properly and does not hold the generator voltage constant then the following procedure may be used until the voltage regulator is repaired. Turn the Exciter Field Rheostat to the extreme "Lower" position; turn the Voltage Adjusting Rheostat to the extreme "Raise" position; then turn the Exciter Field Rheostat until the voltage of the generator is 230 volts. The voltage regulator is now out of operation and the generator voltage must be controlled manually by the Exciter Field Rheostat. Each time the load on the generator is changed the operator must readjust the Exciter Field Rheostat to hold the generator voltage at 230 volts.

(d) Battery charger. - A copper-oxide battery charger is provided in the switchboard to maintain the engine storage batteries fully charged. To operate the battery charger the operator should first turn both of the battery-charging adjusting rheostats to the extreme low position - then close both circuit breakers on the switchboard in the battery charging circuit.

The five engine batteries are connected in parallel across the battery charger through a switch on the engine and through a switch and circuit breaker on the switchboard. Any one of the engine batteries may be charged individually or all may be charged simultaneously by closing the individual switches at the engine bases, closing the circuit breakers at the switchboard and adjusting the rheostats to the charging rates desired. All batteries may be charged simultaneously at a rate of 12 amperes each or any one or two batteries may be charged at one time at a rate of 15 amperes each.

Both the primary and the secondary of the battery charger are protected by fuses located in the interior of the switchboard. If the battery charger fails to operate, these fuses should first be checked for failure.

(2) Sluice gates. - To place this station in operation the operator should close the sluice gate on the intake to the discharge conduit and open the sluice gate to the propeller pump sump. The sluice gate on the discharge end of the conduit on the river side of the dike is for emergency use in the event of failure of the discharge conduit.

Both of the sluice gates at the pumping station may be operated electrically by operating the appropriate push-buttons on the gate hoists after the electrical feeders to the gate hoists have been energized from the switchboard. In emergency, the gate hoists may be operated manually by moving the control lever on the gate hoist to the "Manual" position. If difficulty is experienced in latching the handle in either the "Manual" or "Motor" position, the handwheel should be turned with one hand while moving the lever with the other hand.

The white light, when lighted, indicates that the gate hoist is ready for motor operation from the push-button station. If the white light is not lighted the control circuit is inoperative for reasons of which the following are the most common:

(a) Feeder is not energized at switchboard;

(b) Lever changing hoist operation from "Manual" to "Motor" is not fully latched in the "Motor" position;

(c) Overload thermal trips on motor starter panel operated and opened control circuit. This is caused probably by attempting to close gate with some foreign material in bottom of gate opening. To reset those trips open the door of the control panel and press button in lower left-hand corner of box. If the overload trips have operated for any other reason than that of trying to close the gate against obstructions in the gate opening, the cause of the overload should be determined and corrective measures taken.

If difficulty is encountered in closing a gate due to silt or debris on the bottom of the gate opening, the gate should be closed as far as possible, then a pump started and water pumped out until there is a two or three foot difference in head at the gate. Then by raising the gate a little it may be possible to wash out the gate opening thus allowing proper seating of the gate.

A limit switch on each gate stops the travel of the gate at the maximum open and closed positions. At each fully open and fully closed position an indicating light shows the position of the gate and indicates that the limit switch has operated.

(3) Pump engines and propeller pumps. - The steps as outlined below should be followed in starting one of the propeller pumps:

(a) Check elevation of water in sump to make sure that impellers are submerged. Propeller pumps have a set of bronze rings near the impeller that depend on water for lubrication. These pumps should never be operated for longer than two minutes without water above the impeller as otherwise the pumps could be severely damaged. Turn the crank on automatic lubricator several revolutions to feed some oil down to the bearing cover pipe. If pump has not been started for more than a month pour one pint of oil into pipe feeding pump bearings cover pipe.

(b) Check flexible coupling between engine and gear unit to see that it is properly assembled and filled with grease.

(c) Check lubricating oil level.

(d) Turn on cooling water supply to engine and make sure water is circulating through engine.

(e) Pump up gasoline by use of hand gasoline pump.

(f) Retard spark.

(g) Set throttle lever approximately one-half inch from fully closed position.

(h) Close both ignition switches.

(i) Depress low-oil-pressure cut-out switch with foot and hold down until after engine has started and oil pressure has built up to 10 pounds.

(j) Press "Start" button and choke as much as necessary to start engine and maintain engine firing evenly.

(k) Do not overchoke as this results in washing the lubricating oil from the cylinder walls and dilution of the crankcase oil.

(l) As soon as engine starts advance spark.

(m) Set throttle to maintain an engine speed of 600 R.P.M. and allow engine to warm up for five minutes.

(n) Check oil pressure gage on gear unit. Gage should show a positive pressure. If no pressure is indicated stop engine and determine cause of lack of oil pressure.

(o) After the five minute warm-up period move throttle to fully open position. Governor will maintain an engine speed of 1200 R.P.M. If a pumping speed lower than this is desired adjust throttle to give desired speed.

(4) Gasoline electric generator unit. - The engine on this unit is similar to the pump engines and is operated the same. The governor on this unit should be kept closely adjusted to give as near an engine speed of 1200 R.P.M. as possible because the speed of this unit determines the frequency of the alternating current being delivered to the switchboard. Any appreciable difference in the frequency from 60 cycles (the frequency of the generator output at 1200 R.P.M.) will cause overheating and malfunctioning of electrical apparatus.

(5) Twenty-inch sewage pump. - Before starting the 20-inch sewage pump the operator should make sure that the pump is primed. This may be ascertained by opening the gate valve on top of the discharge section of the pump. If the pump is primed water will flow out of this valve. If the pump is not primed the opening of this valve will allow all air in the pump to escape provided there is a head of water on the pump. When all air has been expelled from the pump and water flows from this valve, the valve may be closed and pump operation begun.

The operation of the pump is controlled from the switchboard. To start the pump the circuit breaker feeding the pump controller should first be placed in the "ON" position. Then the pump may be started by turning the speed controller to the "OFF" position and pressing the "Start" button of the push-button station on the switchboard. The pump may now be brought up to speed by turning the speed controller one notch at a time, allowing approximately five seconds to elapse between steps. The pump may be operated continuously at any speed desired without injury to any of the equipment.

In the event of a sustained overload on the pump, a thermal trip in the switchboard will stop the motor. After the cause of the overload has been determined and corrective measures taken the "Reset" button on the switchboard should be momentarily depressed and then the motor may be started as instructed above.

The stuffing box on the pump should be adjusted so that a small trickle of water leaks through it all the time. If the pump has been dry for a long period of time the stuffing box will leak considerably when the pump is first filled with water. However, as the packing expands when wet thus lessening the flow, care should be exercised when starting the pump after a long inoperative period to see that the stuffing box packing does not swell and bind the pump shaft.

The grease cups on the pump and steady bearing should be turned down a bit after every few hours of operation. Only a little grease should be fed to these bearings as too much grease is injurious to anti-friction bearings.

The pump should never be operated for more than thirty seconds without water in it as the wearing rings in the pump are built with very close tolerances and depend on water for lubrication.

(6) Heating system. - An oil fired heating system is provided to maintain temperatures above freezing in the pumping station at all times and to reduce the relative humidity of the air for the protection of equipment from corrosion. A thermostat in the operating room controls the operation of the boiler, and pressuretrols at each unit heater control the operation of the unit heaters. Thus, when the temperature of the operating room falls below that temperature for which the thermostat is set the oil burner starts. A pressuretrol on the boiler acts to maintain a pressure of between 2 pounds and 5 pounds of steam in the boiler at all times the thermostat is calling for heat. As soon as the steam reaches the unit heaters the pressuretrols operate to start the unit heaters and maintain them in operation until there is no more steam reaching the units. A cutout switch controlling the complete system of boiler and oil burner controls is located in the wall behind the boiler. This switch may be turned "OFF" to perform repair or maintenance work on the boiler and oil burner mechanism or for de-energizing the system in the summer months.

(7) Sump pump. - The operation of the sump pump is controlled by the starter on the wall near the sump pump. Provision is made

in the discharge of the sump pump above the engine room floor to connect the discharge into the engine cooling water system in the event the municipal water supply fails. It is recommended that engine cooling water from this source never be used unless it is absolutely necessary.

SECTION IX

DRAWINGS AND SPECIFICATIONS

9-01. DRAWINGS AND SPECIFICATIONS. - Complete sets of contract plans and specifications and factory performance and acceptance tests on equipment were given the Town of East Hartford when the various projects were completed and turned over to the Town for maintenance and operation. A tabulation of these projects and the dates of transfer and acceptance is given below:

Item	Project	Turned Over	Accepted
EH 1	Dike - Sta. 125 + 50 to 129 + 50 - Hired Labor	Oct. 10, 1939	Nov. 30, 1939
EH 2-5	East Hartford Dike	Dec. 13, 1943	Dec. 29, 1943
EH 6a-6b	Cherry and Pitkin St. Pumping Stations	Apr. 23, 1943	May 13, 1943
EH 6c	Meadow Hill Pumping Station	Mar. 24, 1943	May 13, 1943

APPENDIX "A"

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS

MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c–1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls.*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* — (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c–1) (Regs. 9 August 1944, CE SPEWF)

[SEAL] J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 44–12285; Filed, August 16, 1944; 9:44 a. m.]

APPENDIX "B" PAGE

TOWN OF EAST HARTFORD
EAST HARTFORD, CONN.

December 16, 1938

ASSURANCES BY TOWN OF EAST HARTFORD, CONN.

WHEREAS, by Section 3 of the Flood Control Act approved June 22, 1936, known as the Flood Control Act of 1936, no money appropriated under authority of said act shall be expended on the construction of any project until states, political subdivisions thereof, or other responsible local agencies have given assurances to the Secretary of War that they will (a) provide without cost to the United States, all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of War; and

WHEREAS, by the Flood Control Act approved June 28, 1938, local flood protection works were authorized to be constructed on the Connecticut River, at East Hartford, Connecticut, which said works are subject to the provisions of Section 3 of the Flood Control Act of 1936; and

WHEREAS, an allotment of funds has been made for the prosecution of said works.

NOW, THEREFORE, to comply with the requirements of Section 3 of the Flood Control Act of 1936, the Town of East Hartford, pursuant to a resolution made and approved by the electors of said Town on November 8, 1938 at a regular electors' meeting, and pursuant to a resolution made and approved by the Town Council of said Town on November 22, 1938, does hereby assure the Secretary of War that it will comply with the above stated pro-

visions of Section 3 of the Flood Control Act of 1936 with respect to the flood protection works for the Town of East Hartford, referred to above. In accordance with the established policy of the Corps of Engineers the Town of East Hartford, Connecticut will furnish necessary borrow pits with rights of entry thereto.

IN WITNESS WHEREOF, I, JOHN J. BURKE, President of the Town Council of the Town of East Hartford, under authority of the Charter of said Town and the General Laws of the State of Connecticut have hereunto set my hand and caused the Common Seal of the Town of East Hartford to be affixed hereto this sixteenth day of December, 1938.

ATTEST

/s/ GEORGE E. SLYE
Clerk of the Town Council

/s/ JOHN J. BURKE
President of the Town Council

STATE OF CONNECTICUT)
)SS
COUNTY OF HARTFORD)

On this 16th day of December in the year one thousand nine hundred and thirty-eight, before me personally came JOHN J. BURKE to me known, who being by me duly sworn, did depose and say that he resides in East Hartford, Connecticut; that he is the President of the Town Council of the Town of East Hartford, Connecticut, described in and who executed the foregoing instrument; that he knows the Common Seal of the Town of East Hartford, that the seal affixed to said instrument is such Town seal, that it was so affixed by authority of law of said Town, and that he signed his name thereto by like authority.

/s/ DOROTHEA M. BENJAMIN
Notary Public

My commission expires January 31, 1941

TOWN OF EAST HARTFORD
EAST HARTFORD, CONNECTICUT

This is to certify that the following extracts are from the Charter of the Town of East Hartford, Connecticut as adopted by the State Legislature of 1929:

> Section 3 as amended by the State Legislature of 1933: "(a) The Town of East Hartford is authorized to issue its interest-bearing bonds to meet the cost of one or more public improvements, duly authorized under the Charter of the Town, or to refund such bonds, when callable, with bonds in the same outstanding amount and of the same maturity dates."
>
> Section 13: "(b) It is expressly provided that no vote or resolution of the Town Council ordering a public work or improvement which shall require an expenditure of $25,000 or more shall be obligatory on said town unless approved by a majority vote of an electors' meeting, duly warned and held in the five districts for that purpose, which vote shall be by voting machines."
>
> Section 7: "..... The President of the Council shall be chief executive officer of said town and shall sign all contracts, bonds, deeds or other instruments requiring the assent of the town, and shall take care that the terms of the same are duly performed....."

ATTEST:

/s/ GEORGE E. SLYE

Clerk of the Council

East Hartford
December 16, 1938

TOWN OF EAST HARTFORD
EAST HARTFORD, CONNECTICUT

December 16, 1938

To Whom It May Concern:

At a meeting of the Town Council held on November 22, 1938, the following certificate was received from Town Clerk William E. Hines and incorporated in the minutes of the meeting:

To the Town Council:

In accordance with the vote of the Town Council on September 27th, 1938 the following question was placed on the voting machines for the election of November 8th, 1938. "That the sum of $250,000 be hereby appropriated for the purpose of providing funds to defray such part of the cost of constructing dikes as is to be borne by the Town."

The question was inserted in the call and warning of the meeting.

After the polls were closed the results from each district on the above question were compiled and the Moderator announced the result of the ballots as follows: Yes, 3053; No, 539; and he declared the question approved.

ATTEST:

/s/ WILLIAM E. HINES, Town Clerk

ATTEST:

/s/ GEORGE E. SLYE
Council Clerk

APPENDIX "C"

INSPECTION REPORT
FOR
FLOOD PROTECTION SYSTEM, EAST HARTFORD, CONN.

Dike Inspection Report (Part 1) Date _____

	Location (from Sta. to Sta.)	Description
a. Grass or sod:		
b. Damage due to fire:		
c. Rain, wave, current wash or caving banks:		
d. Damage due to rodents:		
e. Damage due to livestock:		
f. Sand boil areas		
g. Trespassing on Right-of-Way:		

INSPECTION REPORT
FOR
FLOOD PROTECTION SYSTEM, EAST HARTFORD, CONN.

Dike Inspection Report (Part 2) Date _____

	Location (from Sta. to Sta.)	Description
h. Damage to toe drains:		
i. Damage to riprap:		
j. Damage to dike crown:		

(ck items if found satisfactory.

If verything is not in order, explain below:

Inspected by: _____

INSPECTION REPORT
FOR
FLOOD PROTECTION SYSTEM, EAST HARTFORD, CONN.

Concrete wall Inspection Report. Date: _____

a. Monolith joints

(1) Expansion material _____

(2) Concrete at joints _____

b. Wall

(1) Cracks _____

(2) Settlement _____

(3) Caving of banks _____

(4) Bank Protection _____

(5) Toe drains _____

c. Trespassing on right-of-way

(1) Excavation _____

(2) Depositing materials _____

(3) Construction _____

(4) Fires _____

Check items if found satisfactory.

If everything is not in order, explain below:

_____

_____

_____

Inspected by: _____

INSPECTION REPORT
FOR
FLOOD PROTECTION SYSTEM, EAST HARTFORD, CONN.

Drainage Structure Inspection Report Date _____

	Location	Condition
a. Valves or gates:		
b. Pipe:		
c. Headwalls:		
d. Riprap:		
e. Catch Basins:		
f. Stone Gutters:		

Check items if found satisfactory.

If everything is not in order, explain below:

_____

_____

_____

Inspected by: _____

C-4

INSPECTION REPORT
FOR
FLOOD PROTECTION SYSTEM, EAST HARTFORD, CONN.

Closure Structure Inspection Report Date _____

	Closures		
	Stoplog #1-Railroad	Bulkhead Door Shell Oil Co.	Stoplog #2-Highway
a. Concrete			
b. Metal Parts			
c. Timbers			
d. Repairs Needed			
e. Parts Needing Paint			
f. Date of Last Trial Erection			
g. Sand Bags Available			

Check items if found satisfactory.

If everything is not in order, explain below:

_____

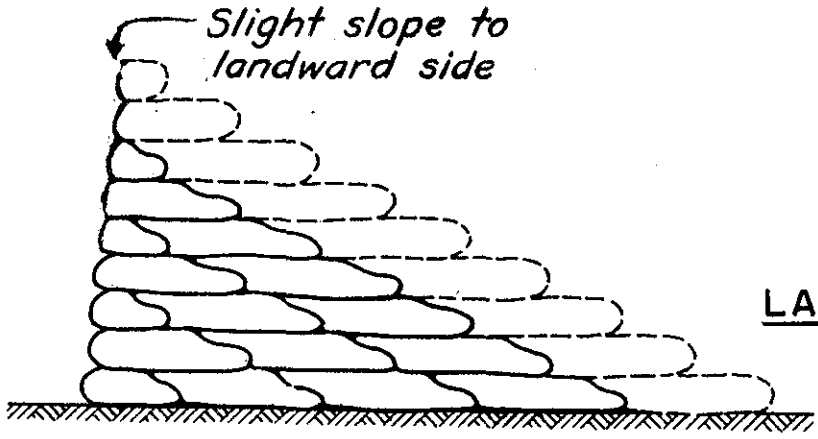
_____

_____

Inspected by: _____

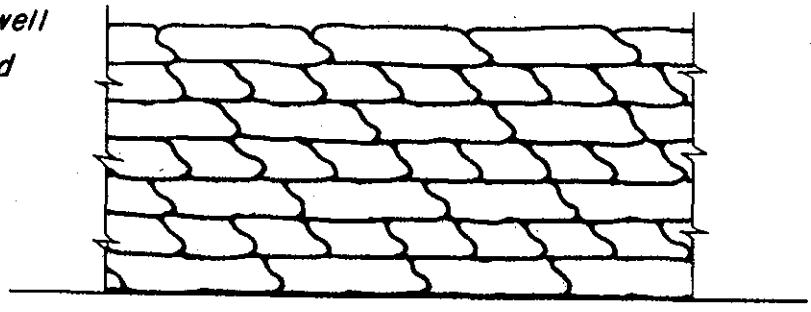
APPENDIX "D"

DRAWINGS	PLATE
STANDARD HIGHWATER MAINTENANCE METHODS	
SACK DIKE OR TOPPING	I
SAND BOIL	II
SACKING SLOUGHS	III
EFFECT OF SAND BOILS ON DIKE	III-A
EMERGENCY FLASH BOARDS	IV
OPERATIONS	
PROJECT MAP OF LOCAL PROTECTION WORKS	V
PLAN AND PROFILE	VI to XIV
DRAINAGE SYSTEM	XV to XX
PUMPING STATION OUTFALLS	XXI to XXII
PROTECTION OF RIVER BED AND BANK	XXIII
CONCRETE FLOODWALL	XXIV to XXV
EMBANKMENT DETAILS	XXVI to XXX
PUMPING STATIONS	XXXI to XXXIII



SECTION

Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.



RIVERSIDE ELEVATION

SACKS REQUIRED PER 100' STA.

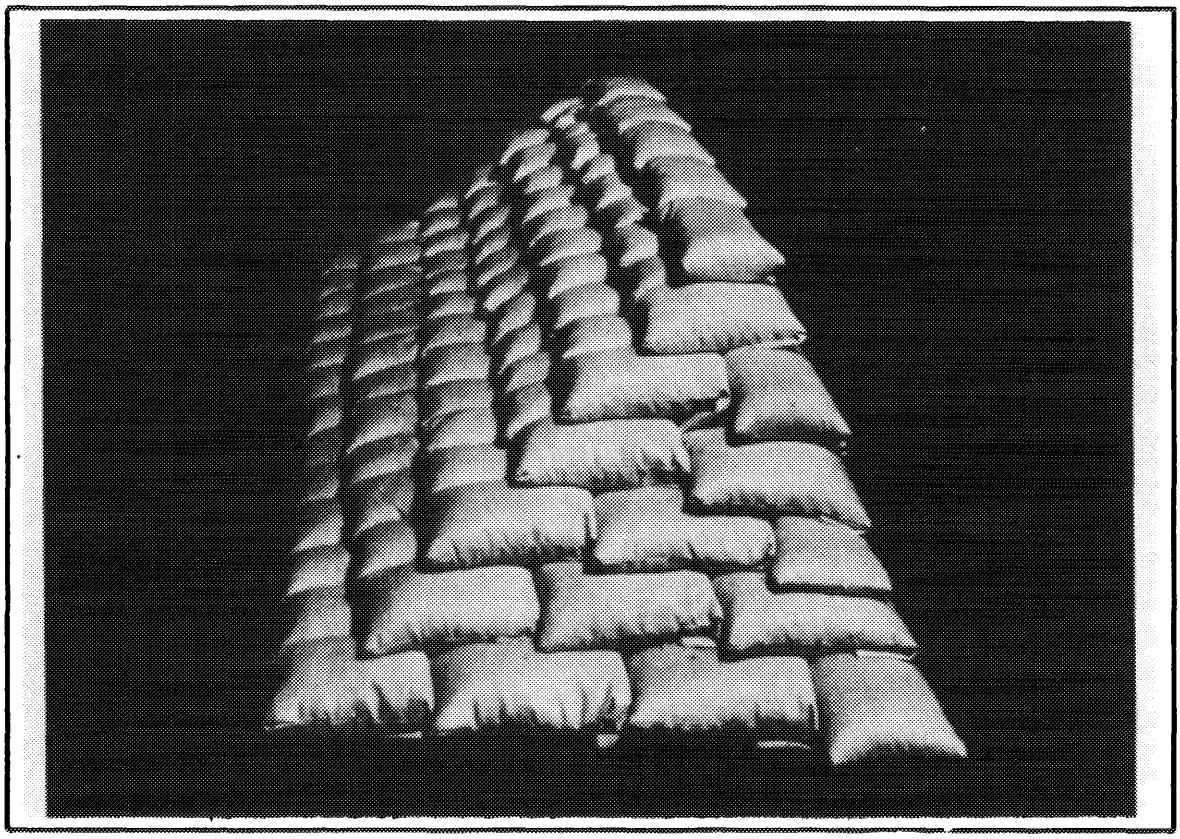
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

SACK DIKE OR TOPPING STANDARD HIGH WATER MAINTENANCE INSTRUCTION

U. S. ENGINEER OFFICE, PROVIDENCE, R. I.

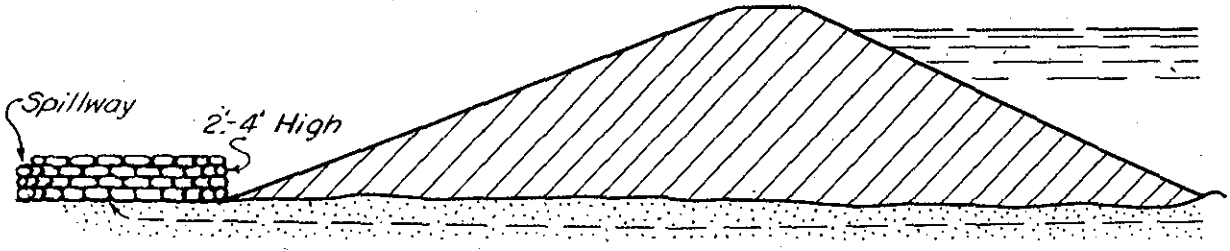
Plate I



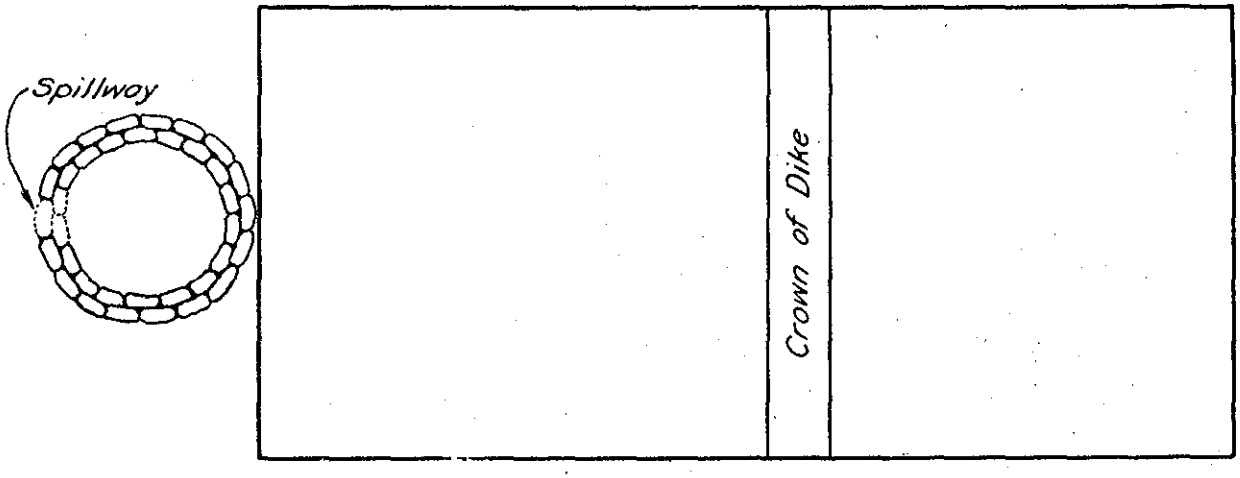
MODEL SACK DIKE OR TOPPING
Typical Section

MODEL SACK DIKE OR TOPPING
Riverside View

PLATE 1A



Wall should be built on firm foundation, with width of base at least 1½ times the height.
Be sure to place sacks on ground clear of sand discharge.
Tie into dike if boil is near toe.



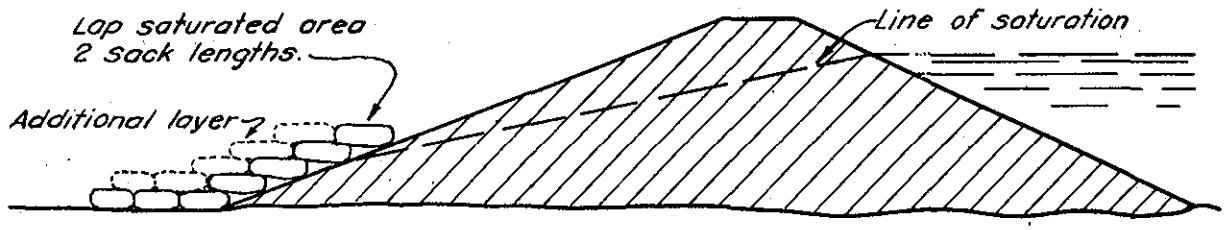
PLAN

Do not sack boil which does not put out material. Height of sack loop or ring should be only sufficient to create enough head to slow down flow through boil so that no more material is displaced and boil runs clear. Do not try to stop fully, flow through boil.

SAND BOIL
STANDARD HIGH WATER
MAINTENANCE INSTRUCTION

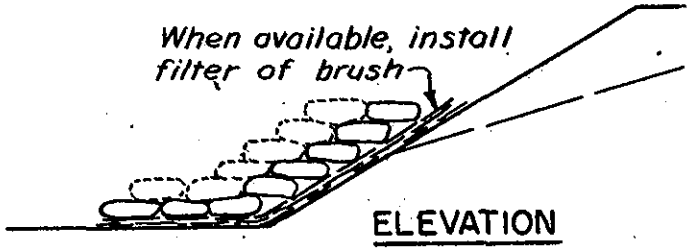
U. S. ENGINEER OFFICE, PROVIDENCE, R. I.

Plate II

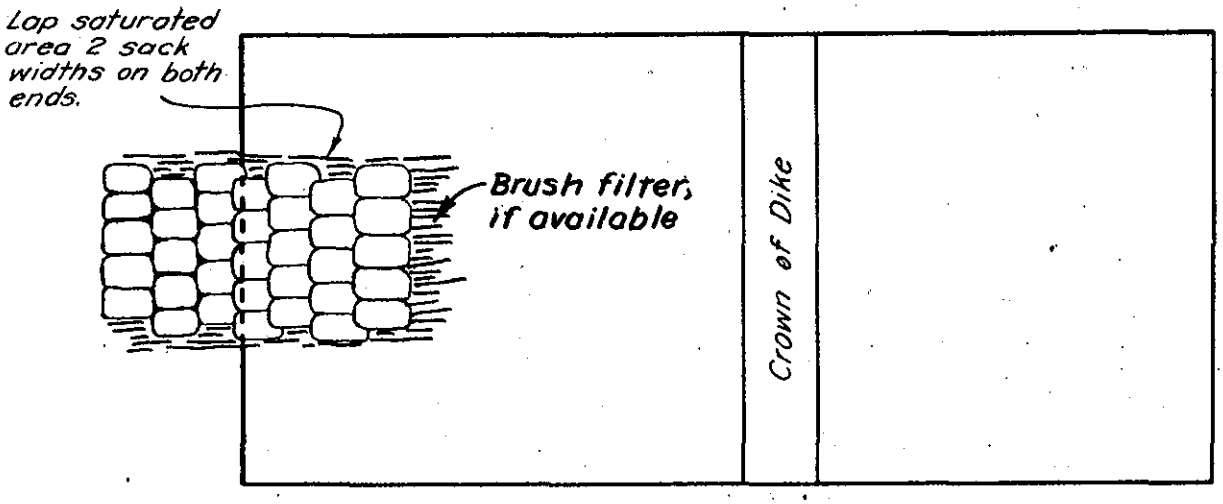


ELEVATION

Number of layers determined by velocity of seepage and amount of material being carried.



ELEVATION



PLAN

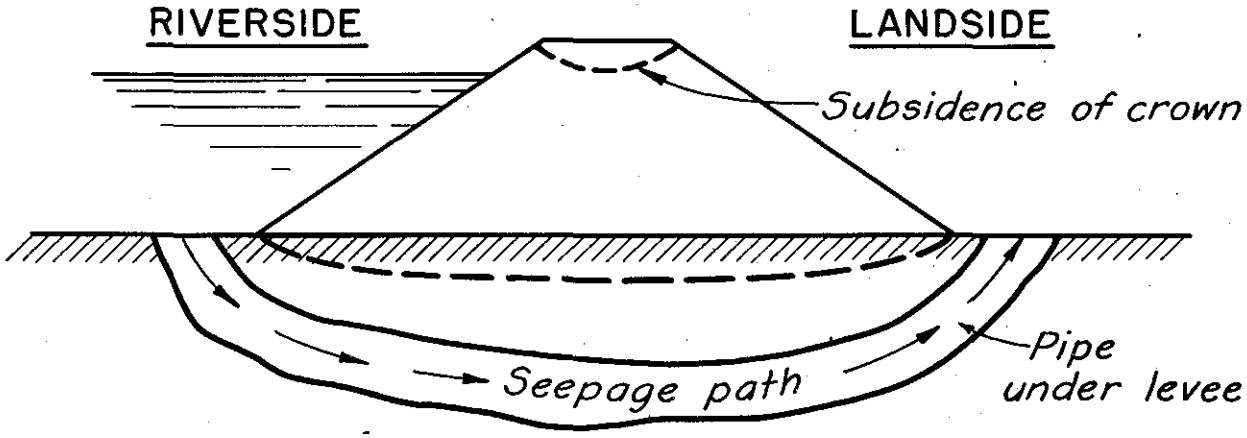
Sacks should be laid shingle fashion and not moulded into place.

SACKING SLOUGHS
STANDARD HIGH WATER
MAINTENANCE INSTRUCTION

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

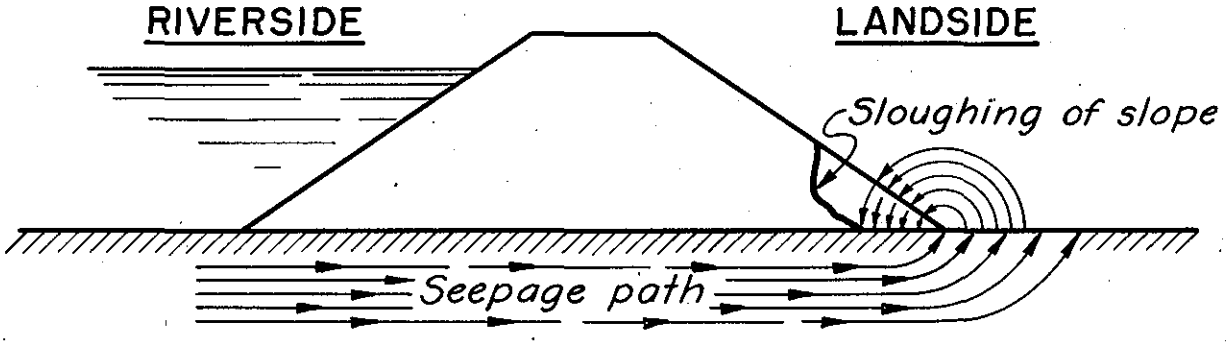
Plate III

EFFECTS OF SAND BOILS ON LEVEE



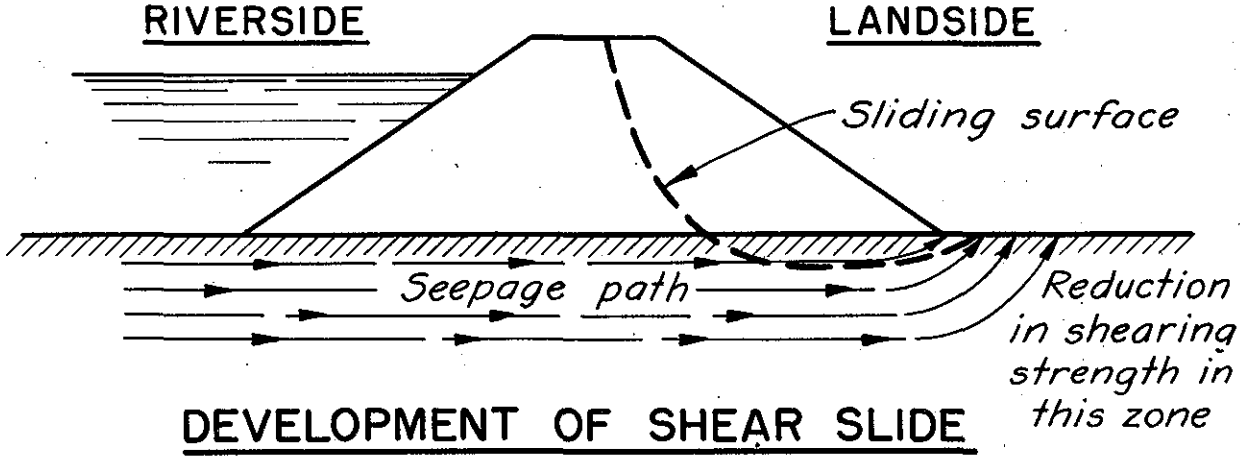
DEVELOPMENT OF PIPE UNDER LEVEE

Fig. 1



SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE

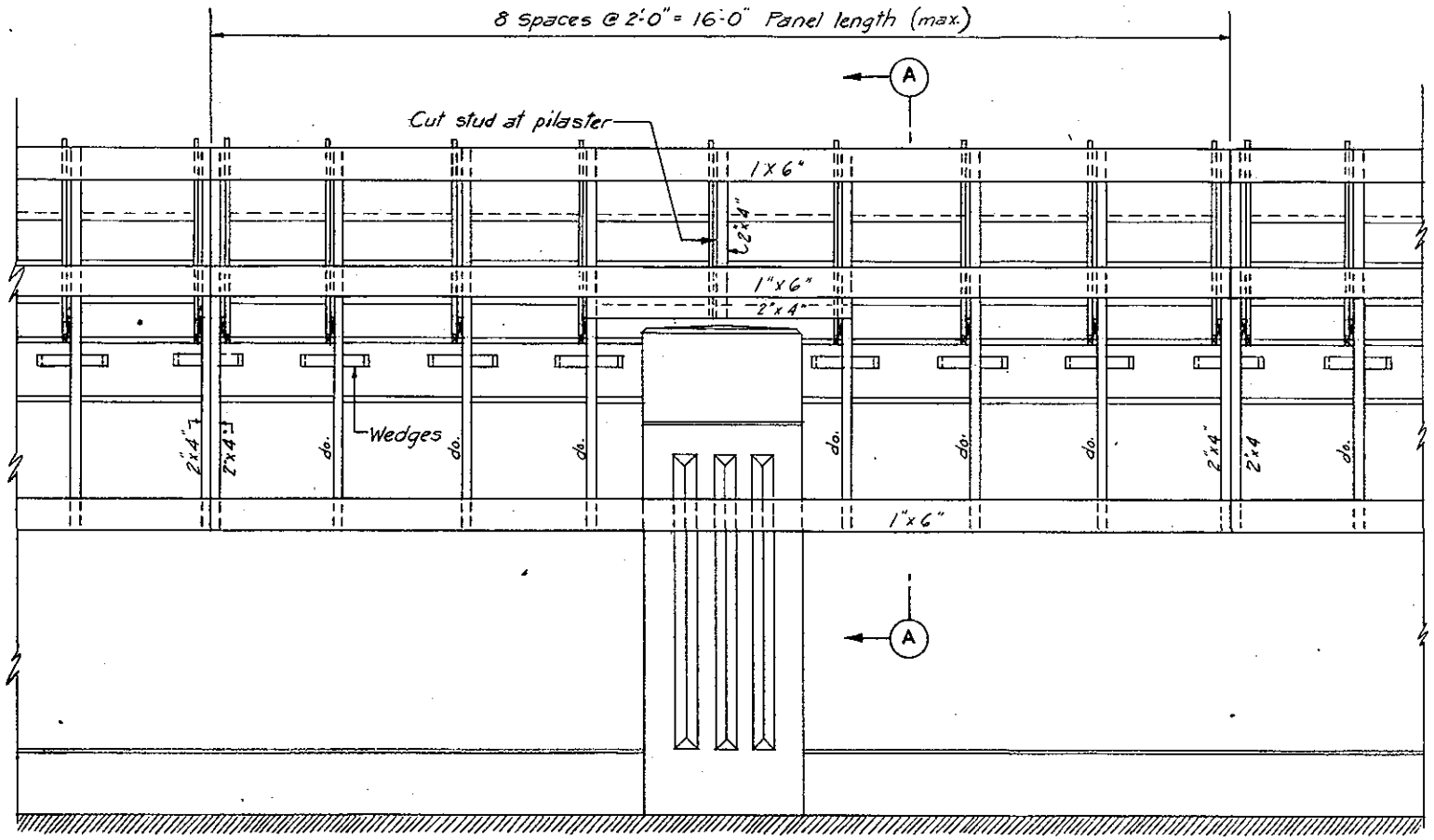
Fig. 2



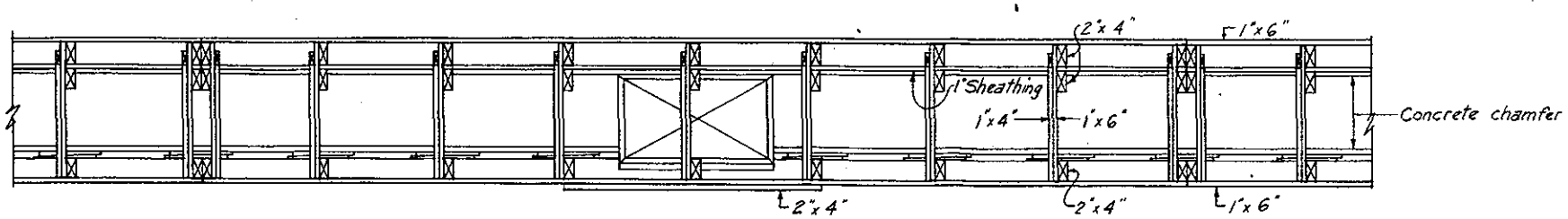
DEVELOPMENT OF SHEAR SLIDE

Fig. 3

PLATE III A



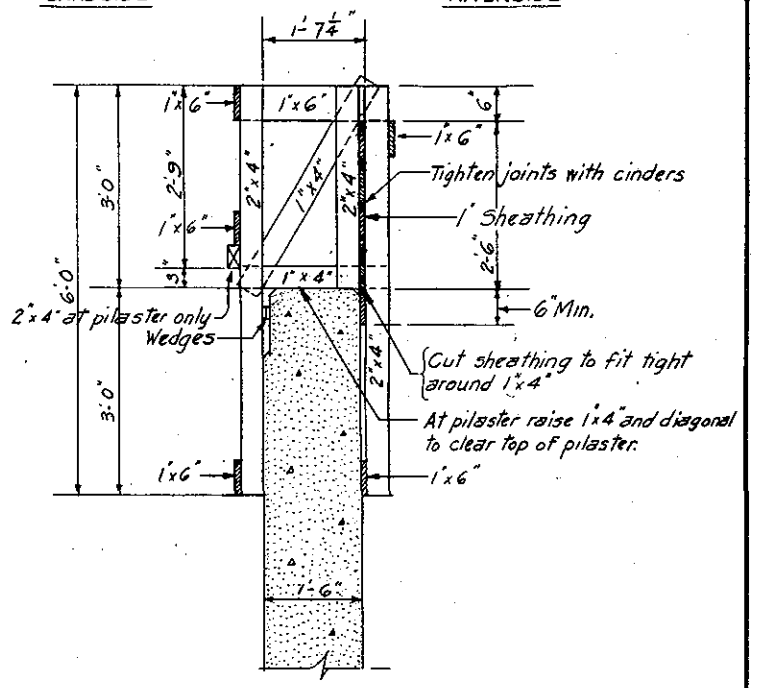
LANDSIDE ELEVATION



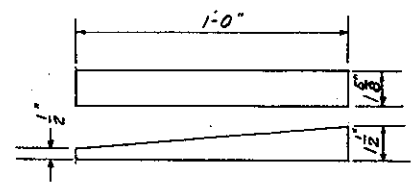
PLAN

BILL OF MATERIALS		
For one 8'-0" panel. Regular wall section.		
Uprights	10 pcs.	2"x 4" x 6'-0"
Vert. brace	5 "	2"x4" x 3'-0"
Stringers	5 "	1"x 6"x 8'-0"
Upper ties	5 "	1"x 6" x 2'-3"
Lower ties	5 "	1"x 4" x 2'-3"
Diagonals	5"	1"x 4" x 3'-6"
Sheathing	6"	1" x 6" x 8'-0" or random widths to make up 36"
Wedges	8	(½" to 1½")x2"x1'-0" = 1-3"x2"x4'-0"
For one 8'-0" panel. Pilaster section Same as above list except:		
Substitute one upright 2"x4"x 2'-9" for one 2"x4"x6'-0"		
Add one stringer piece 2"x4"x 4'-2"		

LANDSIDE RIVERSIDE



SECTION A-A



WEDGE

KEY	DATE	REVISION (Indicated by △)	REV. BY	CK. BY	AP. BY

CONNECTICUT RIVER FLOOD CONTROL

EMERGENCY FLASH BOARDS FOR FLOOD WALLS

CONNECTICUT RIVER MASSACHUSETTS

IN 1 SHEETS SCALE: ¾ IN. = 1 FT. SHEET NO. 1

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1945

SUBMITTED: E. M. Vinton, SENIOR ENGINEER

APPROVAL RECOMMENDED: J. K. Burns, HEAD ENGINEER, CHIEF, ENGINEERING DIV.

APPROVED: W. H. Truesdell, COL. CORPS OF ENGINEERS, DISTRICT ENGINEER

PREPARED: E. J. Hayes, STRUCTURAL SECTION

DRAWN: E. J. H.

TRACED:

CHECKED:

FILE NO. CT-4-3408

PLATE IV

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

22
20
18
16
14
12

Close Bulkhead Door – Shell Oil Co.

Start Cherry Street Pumping Station

Start Meadow Hill Pumping Station

Start Pitkin Street Pumping Station

11.55 UNITED STATES WEATHER BUREAU

11.00 MEAN SEA LEVEL

34
32
30
28
26
24

Close Railroad Stop Log Structure

Close Main Street Stop Log Structure

HOCKANUM RIVER

MAIN ST. STOP-LOG STRUCTURE

Sta 220+00

Sta 210+00

Sta 200+00

Sta 190+00

Sta 180+00

THE SWALE

OUTLET CHANNEL

EAST HARTFORD DIKE

SOUTH SECTION

Sta 240+92.75

Sta 230+00

BREWER LANE

SAUNDERS ST.

CONNECTICUT CO. R.R.

PITKIN ST.

STORAGE POND

MEADOW HILL PUMPING STATION

ACCESS ROAD

MEADOW ST.

HARTLAND ST.

Sta 170+00±

165+00

160+00

155+00

Existing bulkhead

Outfall

145+00

140+00

135+00

150+00

PITKIN ST. PUMPING STATION

DARLIN ST.

GILBERT ST.

FLORENCE ST.

PLEASANT ST.

ASH ST.

SULLIVAN ST.

GOVERNOR ST.

CHERRY ST. (PUMPING STATION

CHERRY ST.

WILSON ST.

VILLAGE ST.

NELSON ST.

JENCKS ST.

R.R. STOP-LOG STRUCTURE

MEMORIAL BRIDGE

129+50±

125+50±

120+00

115+00

110+00

105+00

Outfall

℄ Existing dike

HARTFORD

RIVER

HARTFORD

EAST

TOWN OF

CITY OF

CONNECTICUT

MAIN ST.

GAGE

To Springfield

GREEN TERRACE

ADAMS ST.

ST.

Existing drainage ditch

NORTH SECTION

EAST HARTFORD DIKE

Sta 40+00

Sta 50+00

Sta 60+00

Sta 70+00

Sta 80+00

Sta 90+00

Sta 92+70

Timber pile groins

Area of required dredging

Dumped rock in river bed

℄ Existing dike

GOVERNOR ST.

CONNECTICUT BLVD. SOUTH

PROSPECT ST.

Existing drainage ditch

THE SWALE

Bridge

ASH ST.

N

LEGEND

Improved roads and streets

Unimproved roads and streets

Railroads

Dike

Dike-riverside riprapped

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

GENERAL PLAN

CONNECTICUT RIVER CONNECTICUT

SCALE: IN=400FT.

400' 0 400' 800'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.,

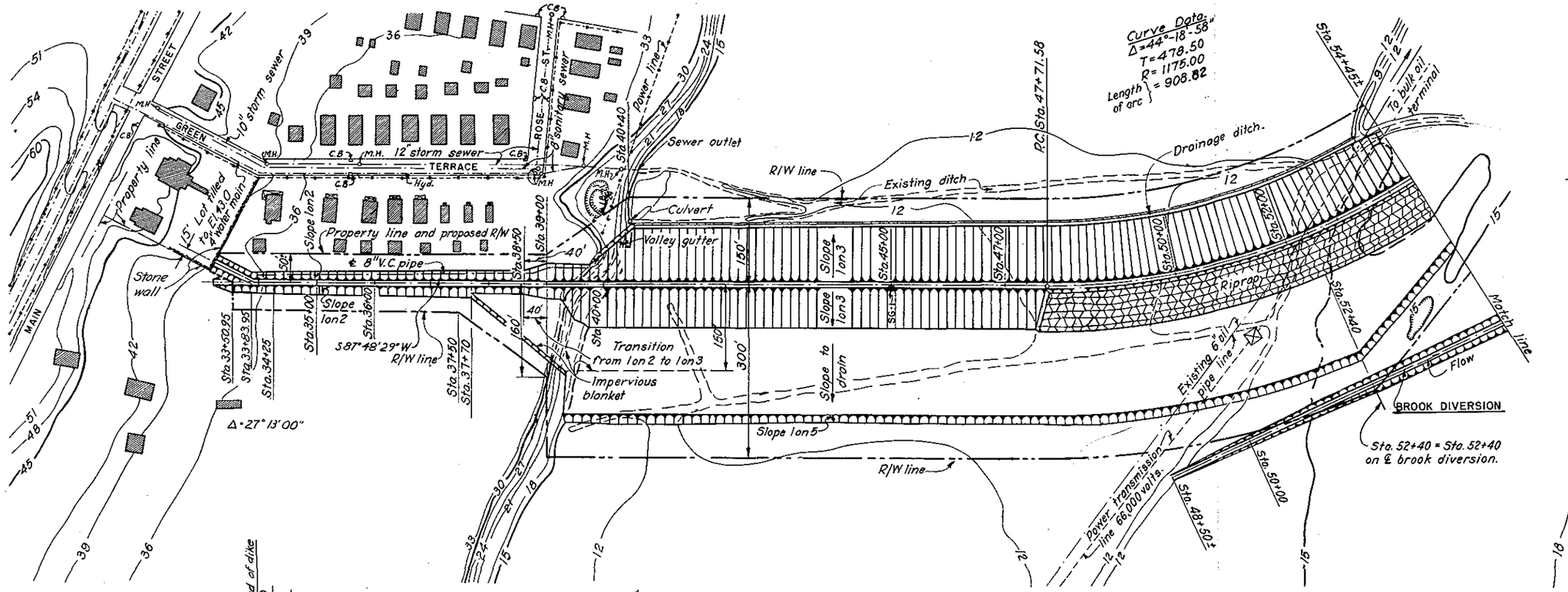
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE V

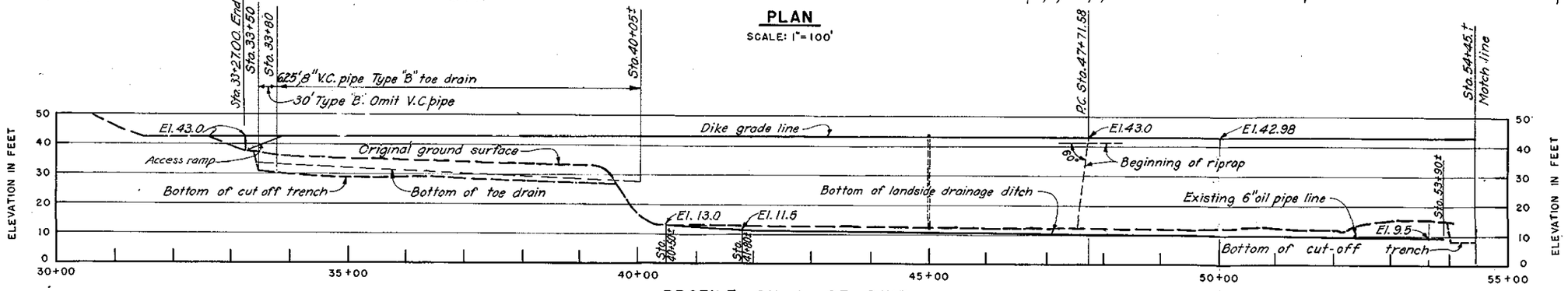
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



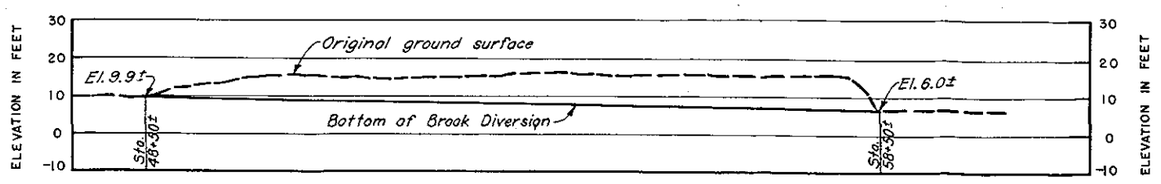
PLAN

SCALE: 1"=100'



PROFILE ON ℄ OF DIKE

SCALE: HOR. 1"=100'
VERT. 1"=20'



PROFILE ON ℄ OF BROOK DIVERSION

SCALE: HOR. 1"=100'
VERT. 1"=20'

NOTES

Elevations refer to Mean Sea Level Datum.
S.G. denotes settlement gage.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. 8 FROM STA. 170 ALONG HOCKANUM RIVER

PLAN AND PROFILE NO. 1

CONNECTICUT RIVER — CONNECTICUT

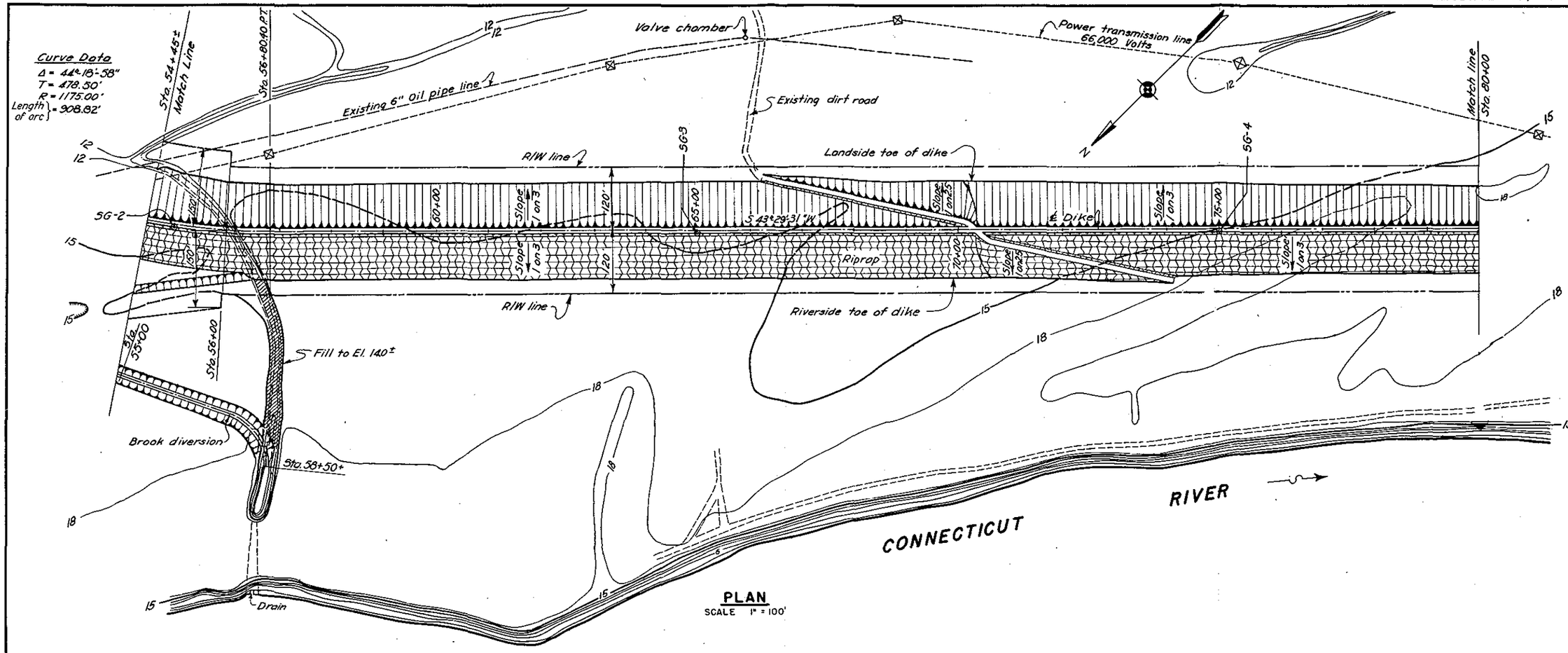
SCALE: 1 IN. = 100 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

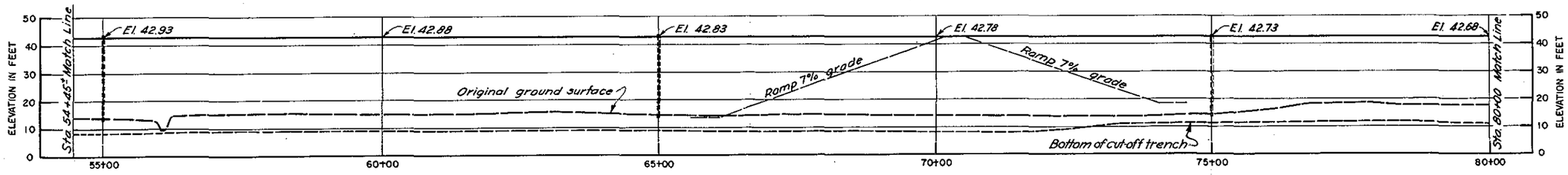
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE VI



PLAN
SCALE 1" = 100'



PROFILE ON ℄ OF DIKE
SCALE: HOR. 1"=100'
VERT. 1"=20'

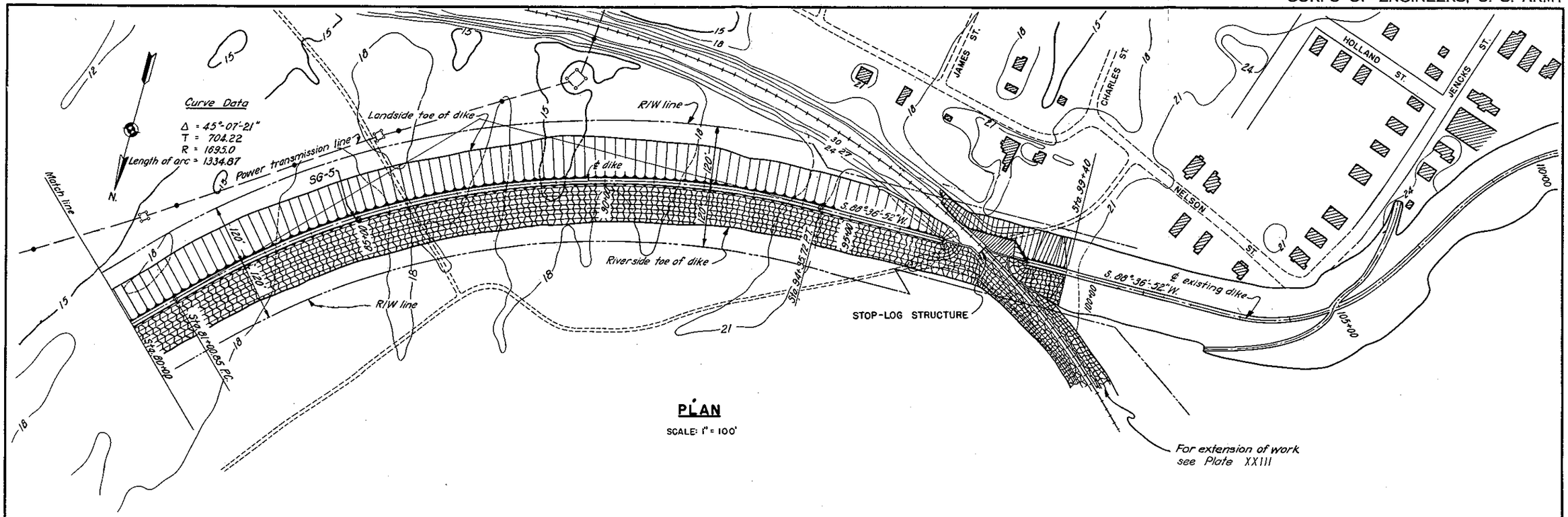
NOTE:
For general notes applying to details on this sheet, see Plate VI

CONNECTICUT RIVER FLOOD CONTROL
EAST HARTFORD DIKE
NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER
PLAN AND PROFILE NO. 2
CONNECTICUT RIVER — CONNECTICUT
SCALE 1 IN. = 100 FT.
U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941
OPERATION AND MAINTENANCE MANUAL
EAST HARTFORD, CONN.

PLATE VII

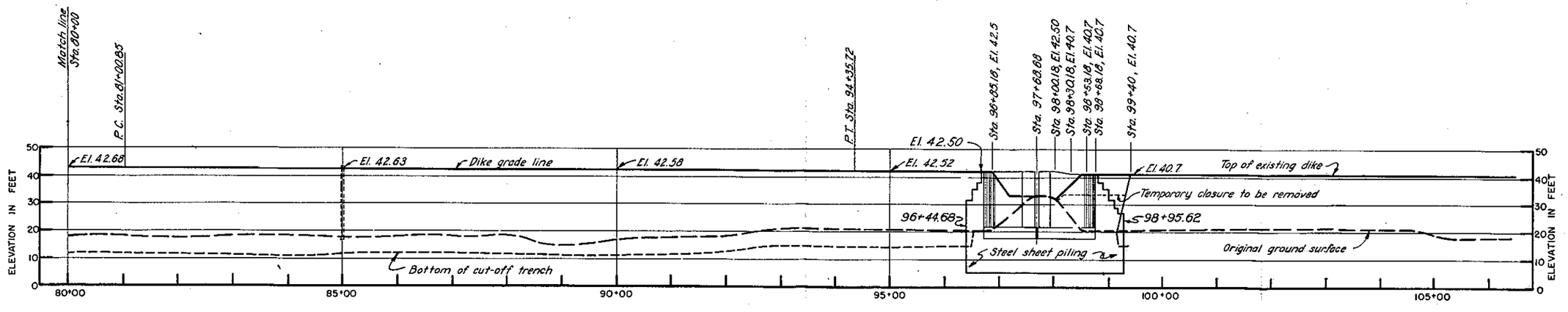
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ DIKE

SCALE: HOR. 1" = 100'. VERT. 1" = 20'

NOTES

For general notes applying to details on this sheet, see Plate VI

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R & FROM STA. 170 ALONG HOCKANUM RIVER

PLAN AND PROFILE NO. 3

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 100 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

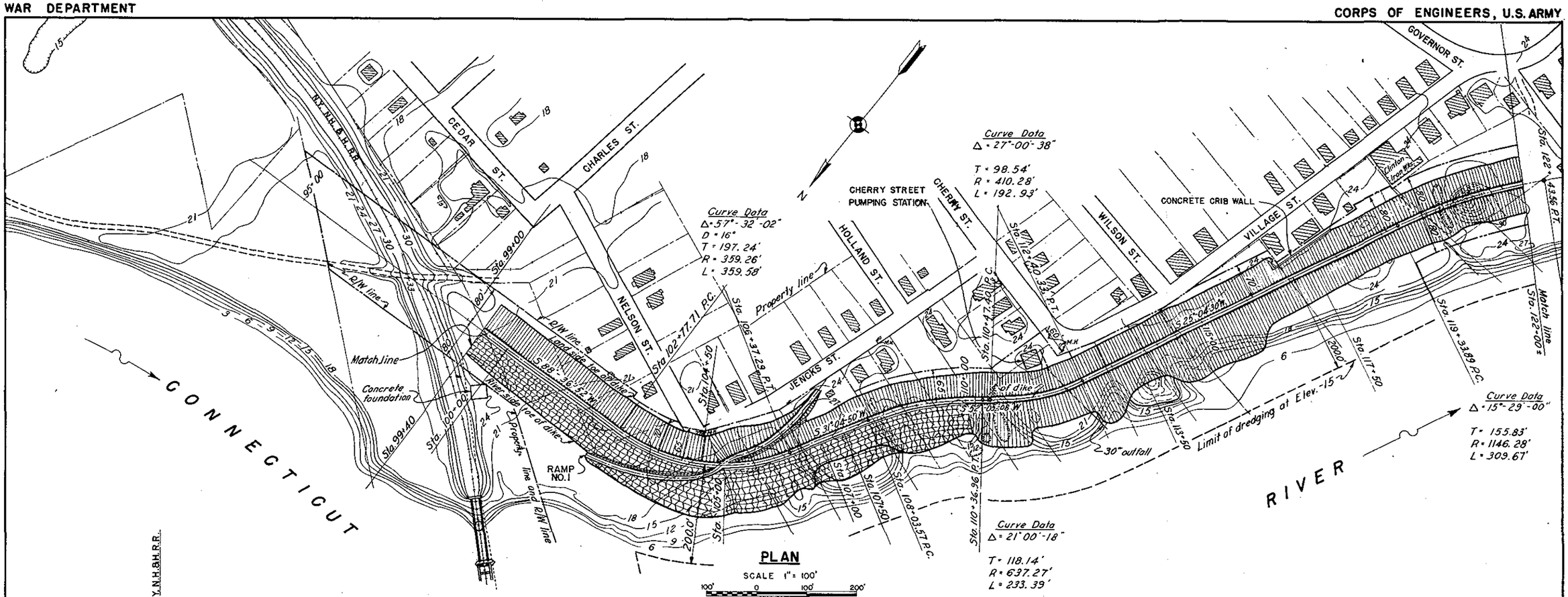
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE VIII

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY



PROFILE ON ℄ OF DIKE

SCALE: HOR. 1" = 100'
VERT. 1" = 20'

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

PLAN AND PROFILE NO. 4

CONNECTICUT RIVER, CONNECTICUT

SCALE: 1 IN. = 100 FT.

100' 0 100' 200'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

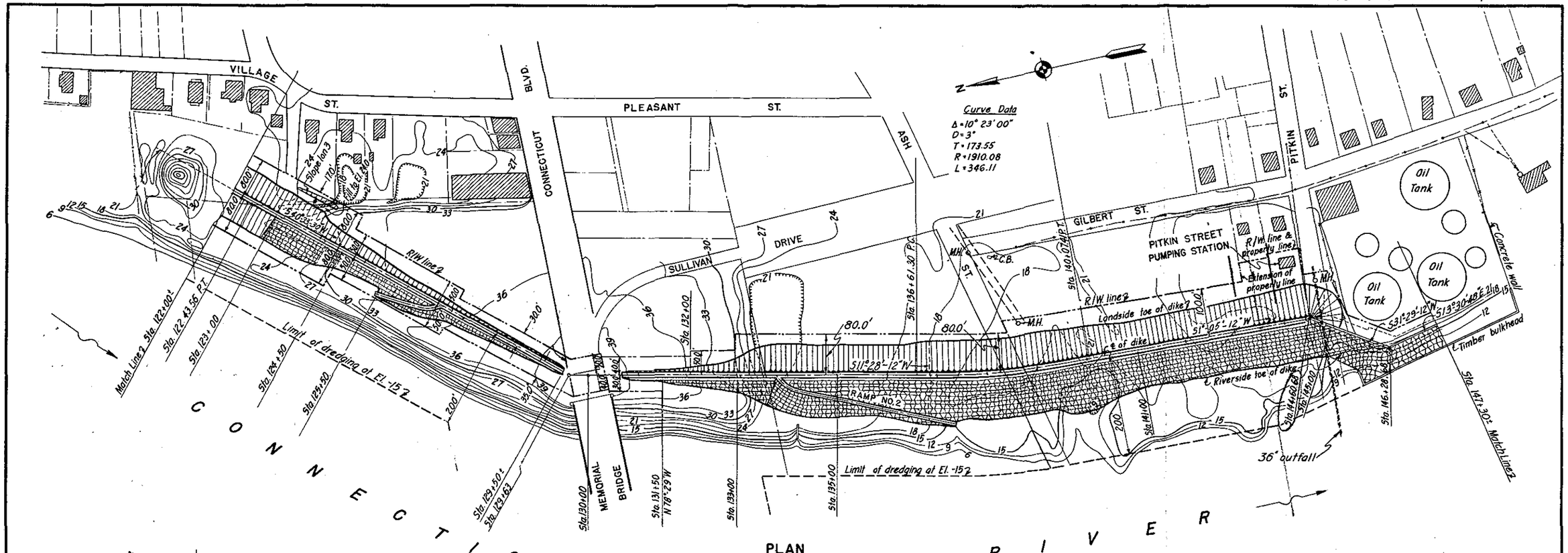
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE IX

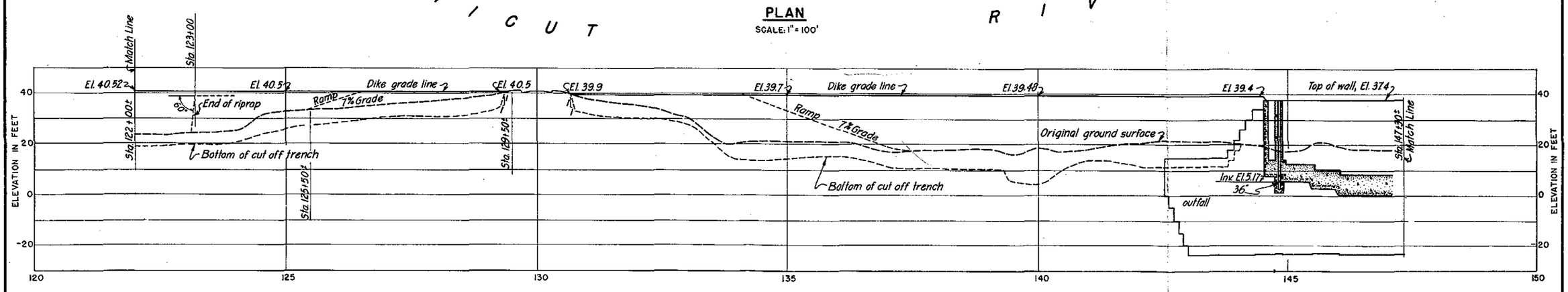
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ OF DIKE

SCALE: HOR. 1" = 100'
VERT. 1" = 20'

NOTES

For general notes applying to details on this sheets, see Plate VI.

13000
1450
14450

14+50

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

PLAN AND PROFILE NO. 5

CONNECTICUT RIVER — CONNECTICUT

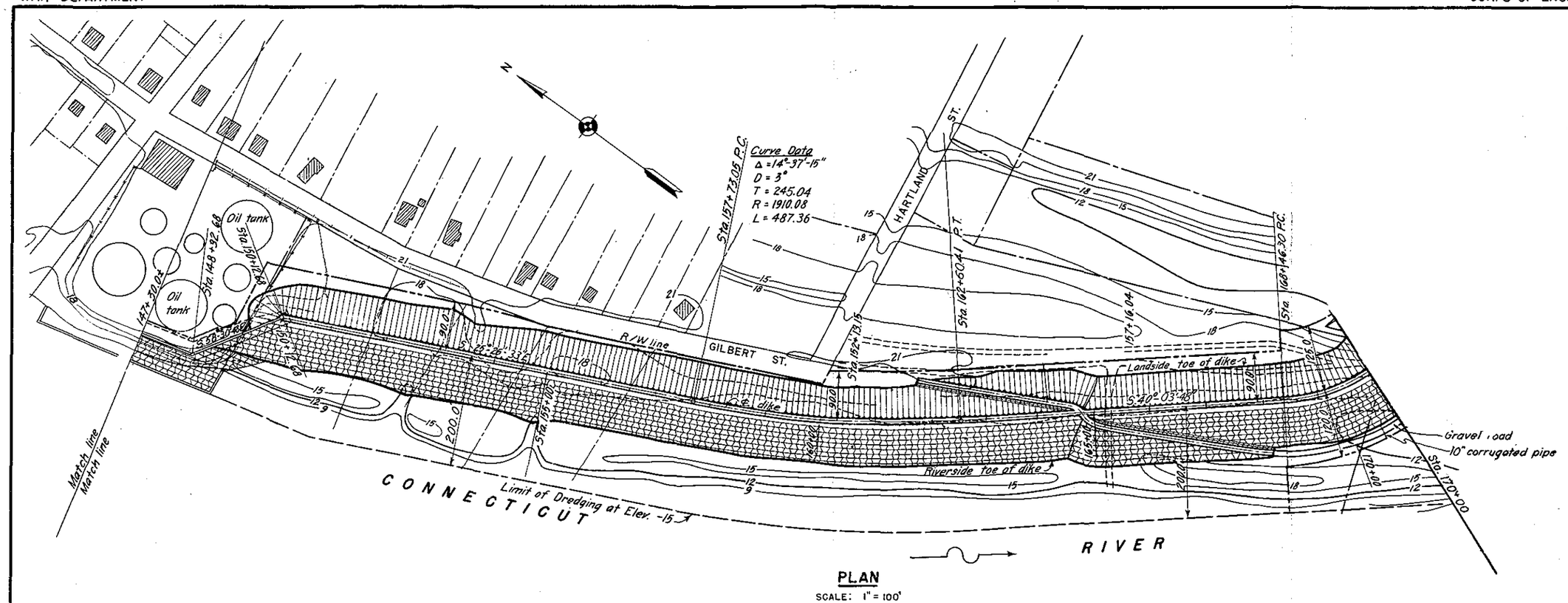
SCALE: 1 IN = 100 F.T.

U. S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

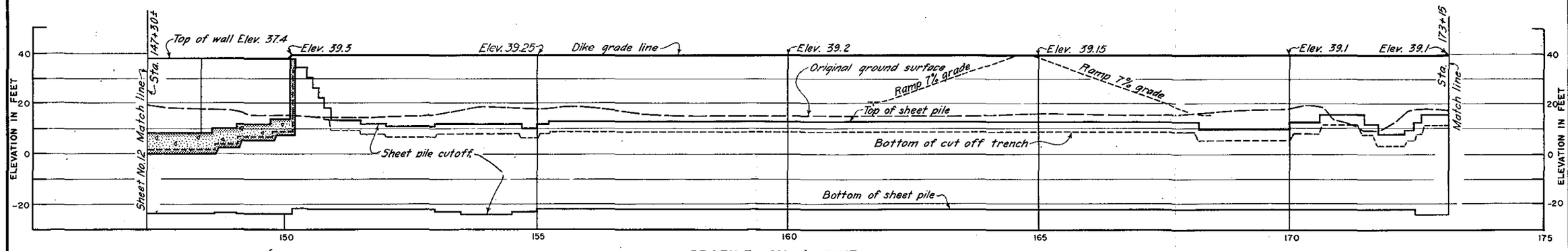
EAST HARTFORD, CONN.

PLATE X



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ DIKE

SCALE: HOR., 1"=100'
VERT., 1"=20'

NOTES

For general notes applying to details on this sheet, see Plate VI.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

PLAN AND PROFILE NO. 6

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN = 100 FT.

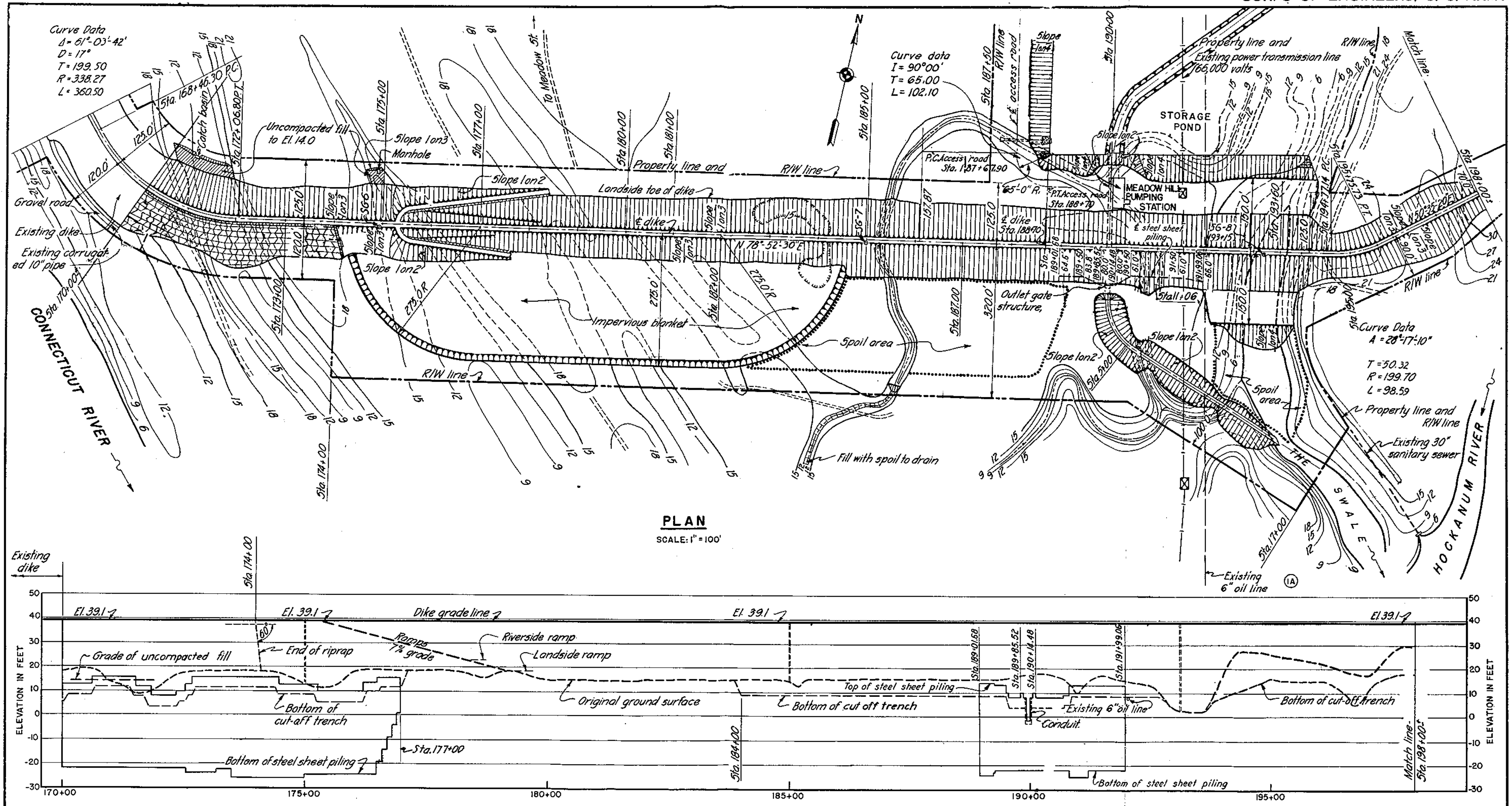
100' 0' 100' 200'

U. S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

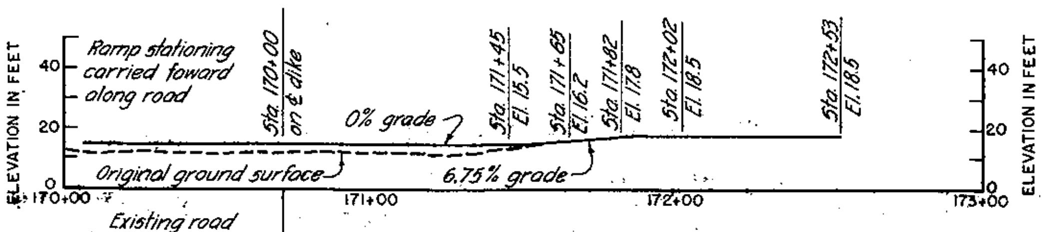
EAST HARTFORD, CONN.

PLATE XI



PROFILE ON ℄ DIKE

SCALE: HOR. 1" = 100', VERT. 1" = 20'



PROFILE ON ℄ GRAVEL ROAD

SCALE. HOR. 1" = 30', VERT. 1" = 30'

NOTE

For general notes applying to details on this sheet see Plate VI

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

PLAN AND PROFILE NO. 7

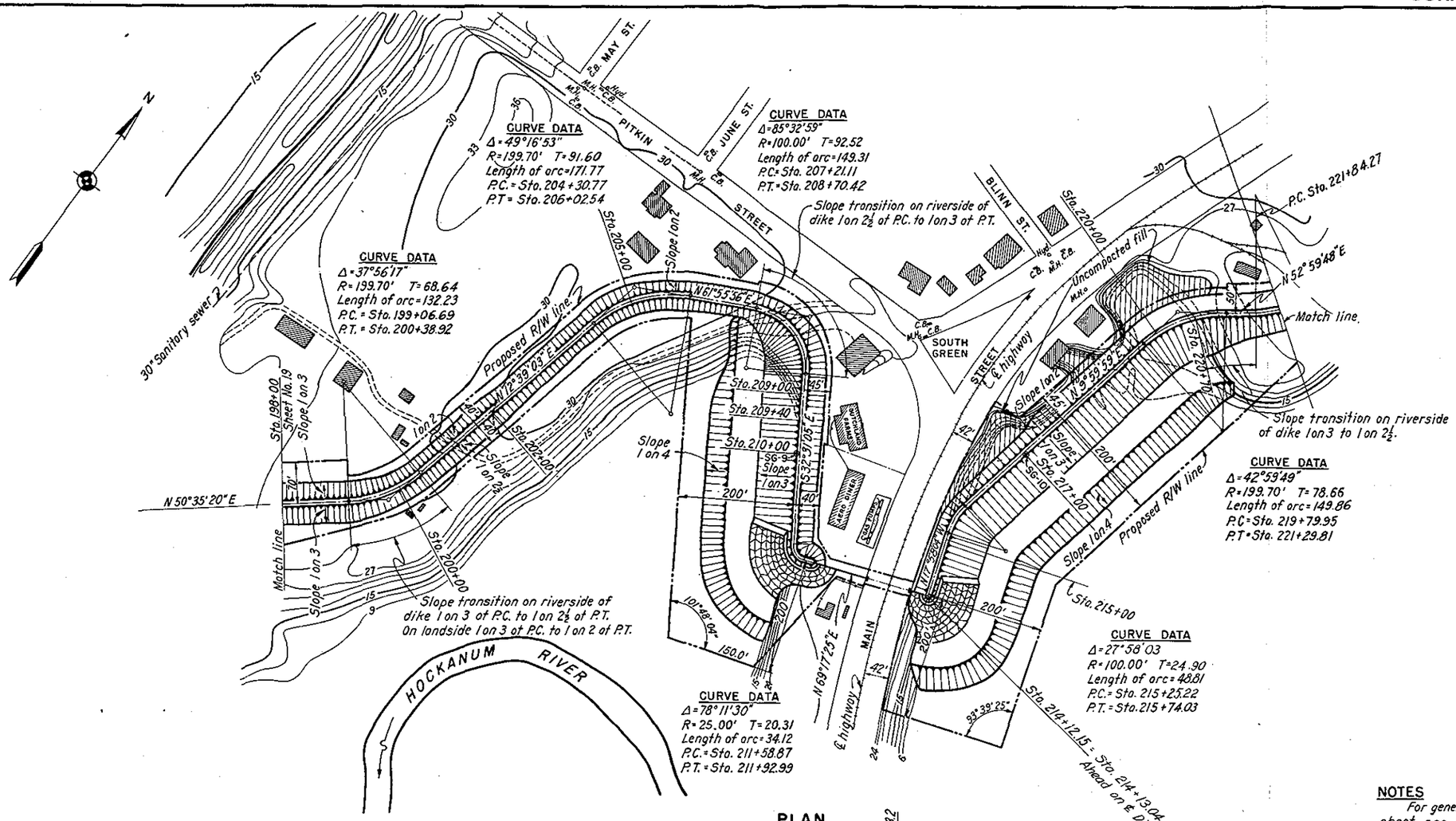
CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 100 FT.

U. S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

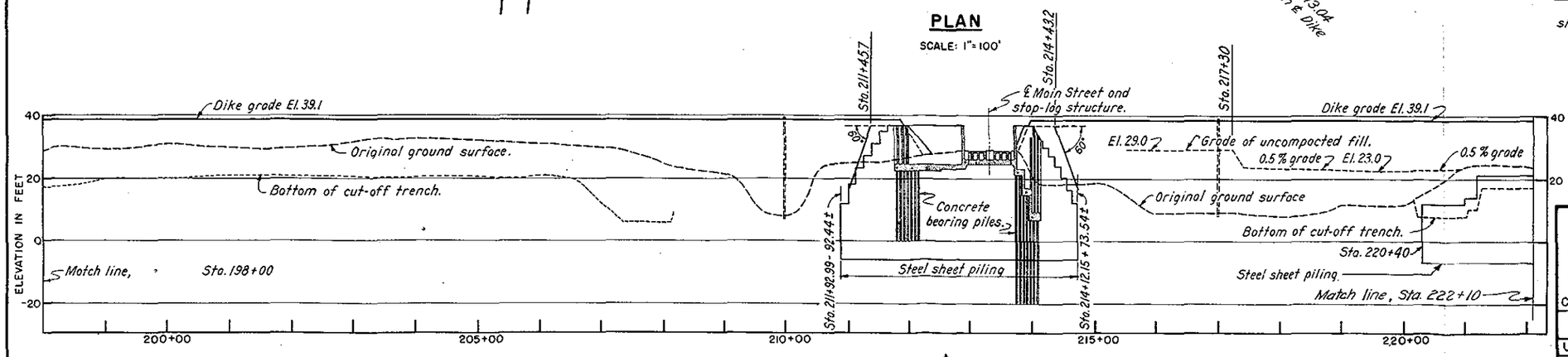
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ DIKE

SCALE: HOR. 1" = 100'
VERT. 1" = 20'

NOTES

For general notes applying to details on this sheet, see Plate VI

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

PLAN AND PROFILE NO. 8

CONNECTICUT RIVER — CONNECTICUT

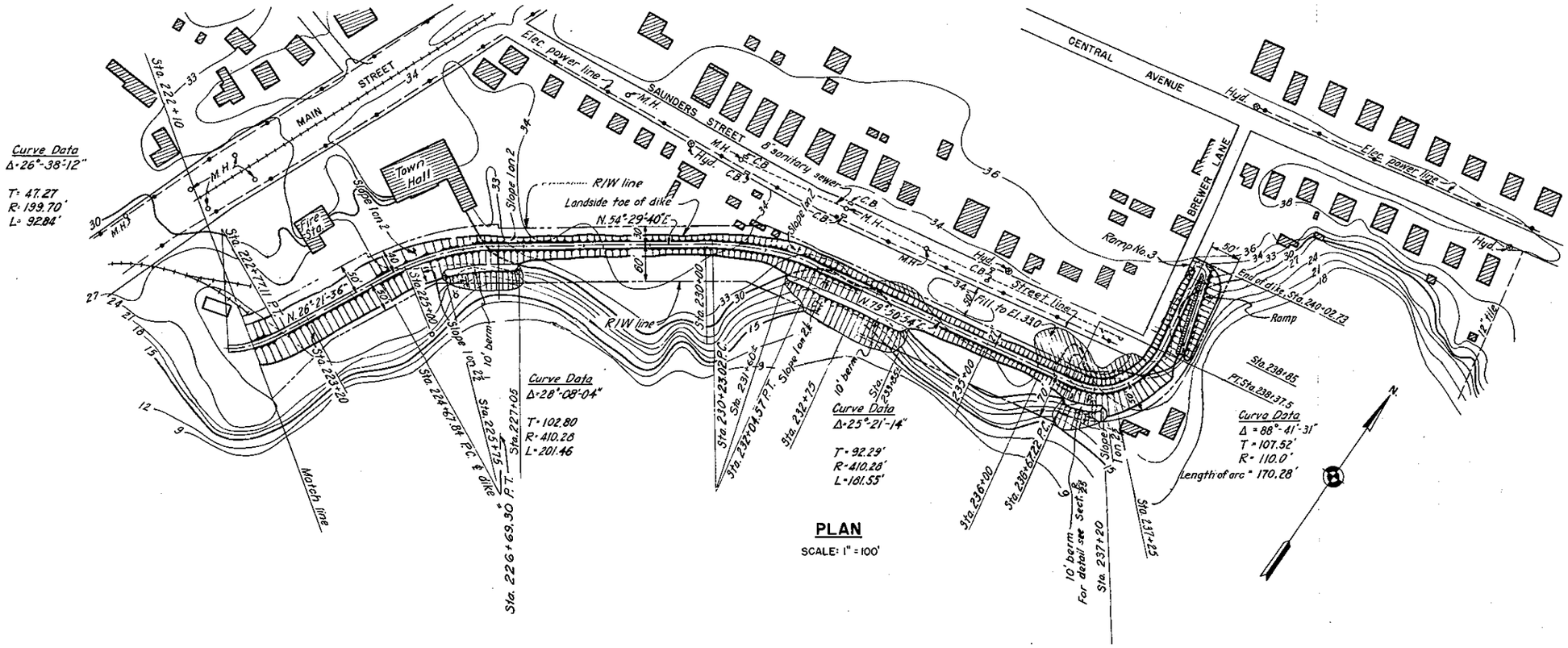
SCALE: 1 IN. = 100 FT.

100' 0 100' 200'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

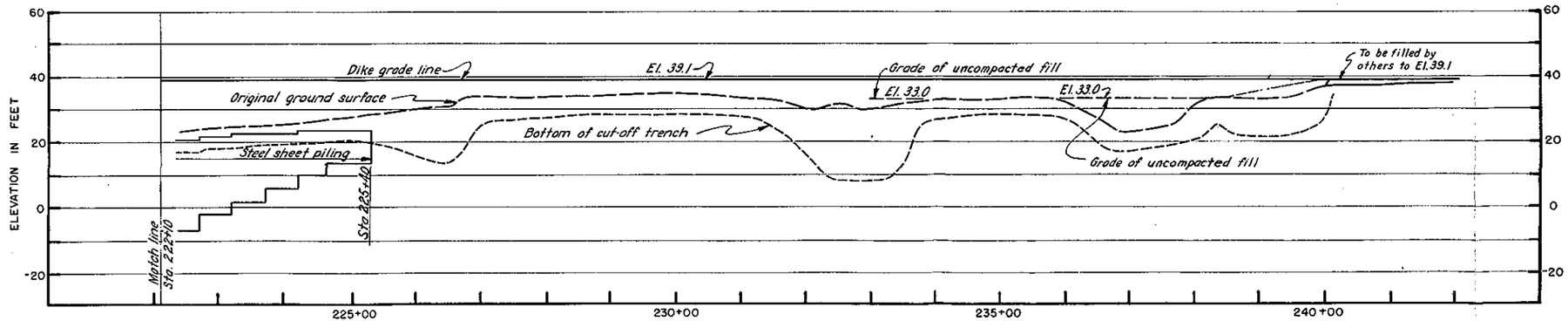
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ DIKE

SCALE: HOR. 1" = 100'
VERT. 1" = 20'

NOTES

For general notes applying to details on this sheet see Plate VI.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

PLAN AND PROFILE NO. 9

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 100 FT.

100' 0 100' 200'

U. S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB., 1941

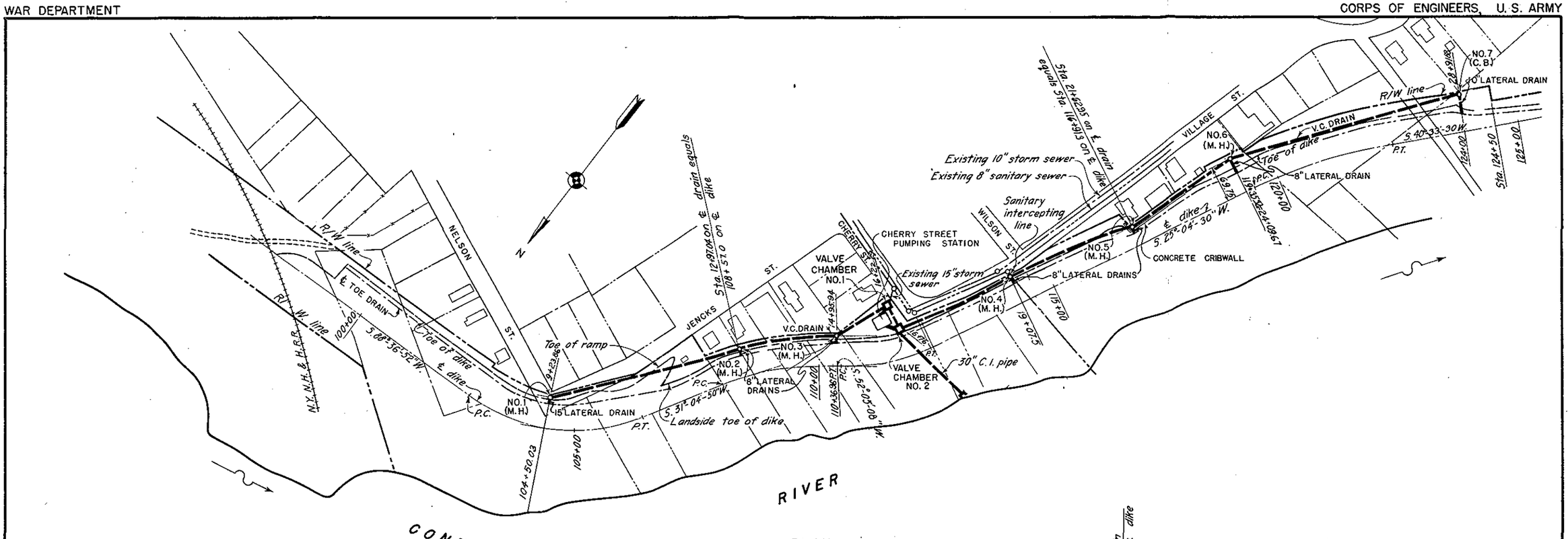
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE XIV

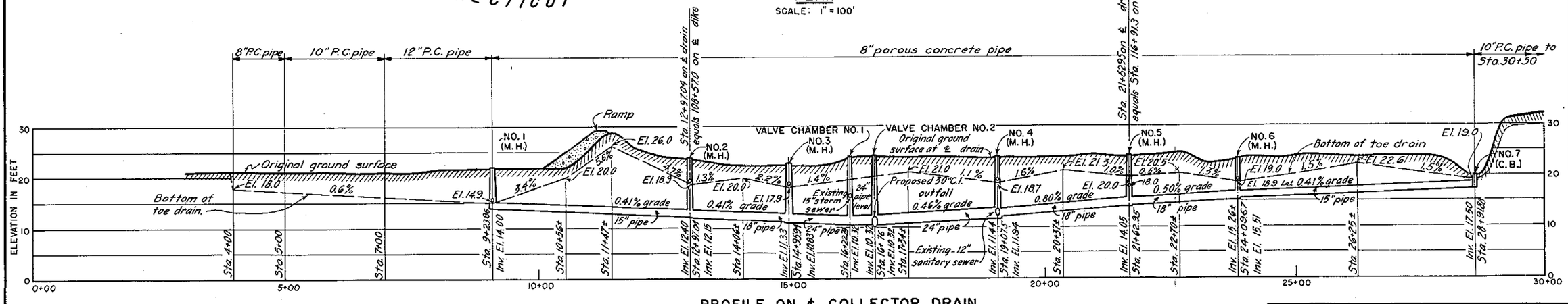
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



PLAN

SCALE: 1" = 100'



PROFILE ON ℄ COLLECTOR DRAIN

SCALE: HOR., 1"=100'
VERT., 1"=10'

NOTES

All pipes shall be vitrified clay unless otherwise noted.

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

DRAINAGE SYSTEM NO. 1

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1IN.= 100 FT.

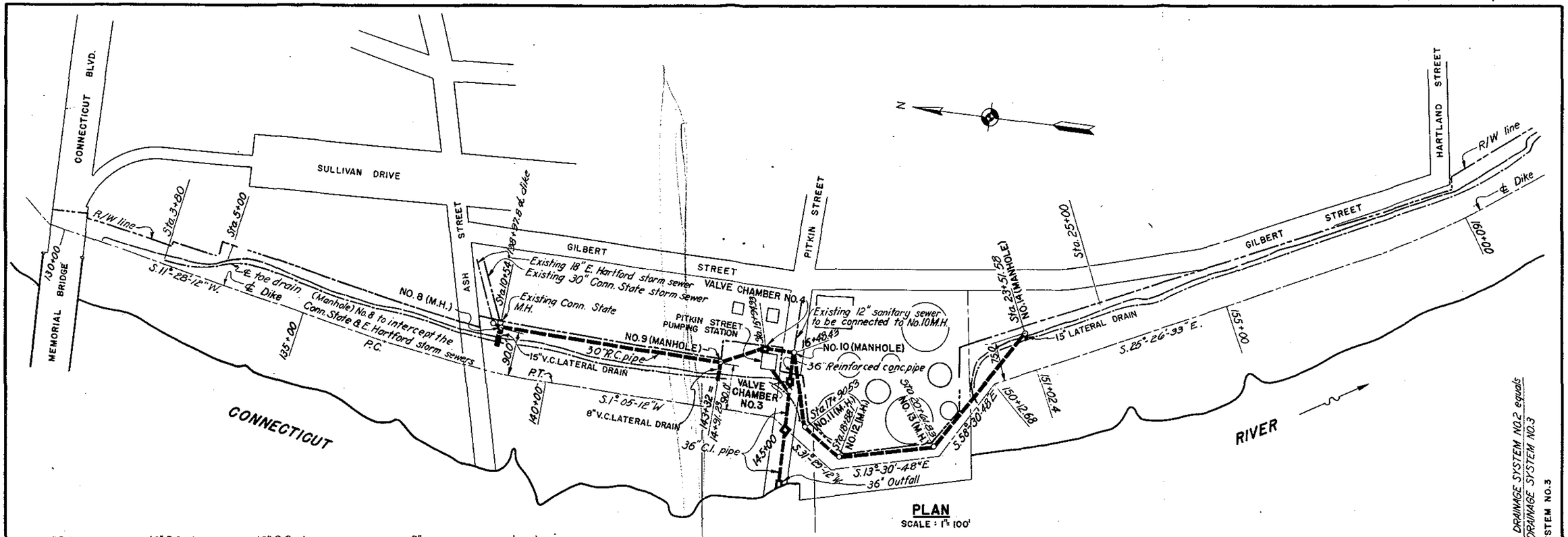
100' 0 100' 200'

U.S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1939

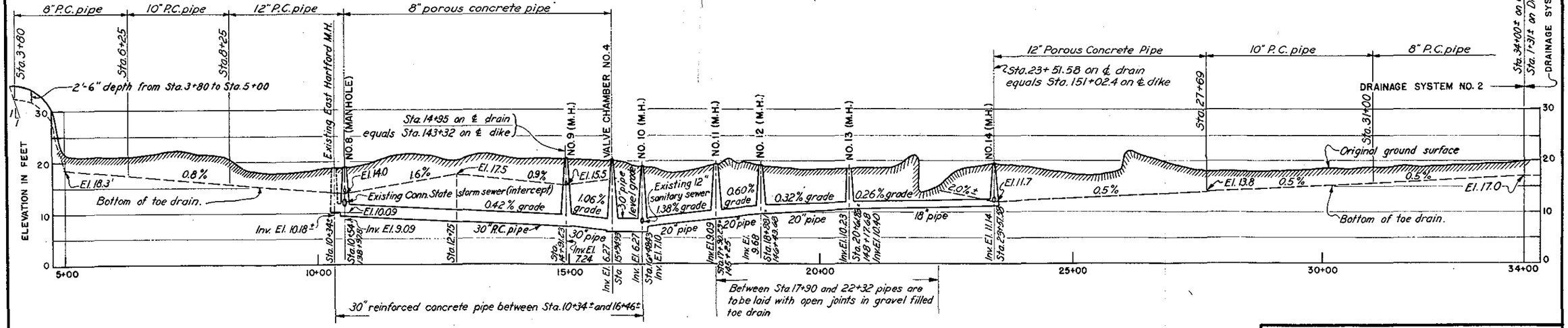
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE XV



PLAN
SCALE : 1" = 100'



PROFILE ON ℄ COLLECTOR DRAIN

SCALE: HOR. 1" = 100'
VERT. 1" = 10'

NOTES

For notes applying to details on this sheet see Plate VI

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

DRAINAGE SYSTEM NO. 2

CONNECTICUT RIVER, CONNECTICUT

SCALE: 1 IN. = 100 FT.

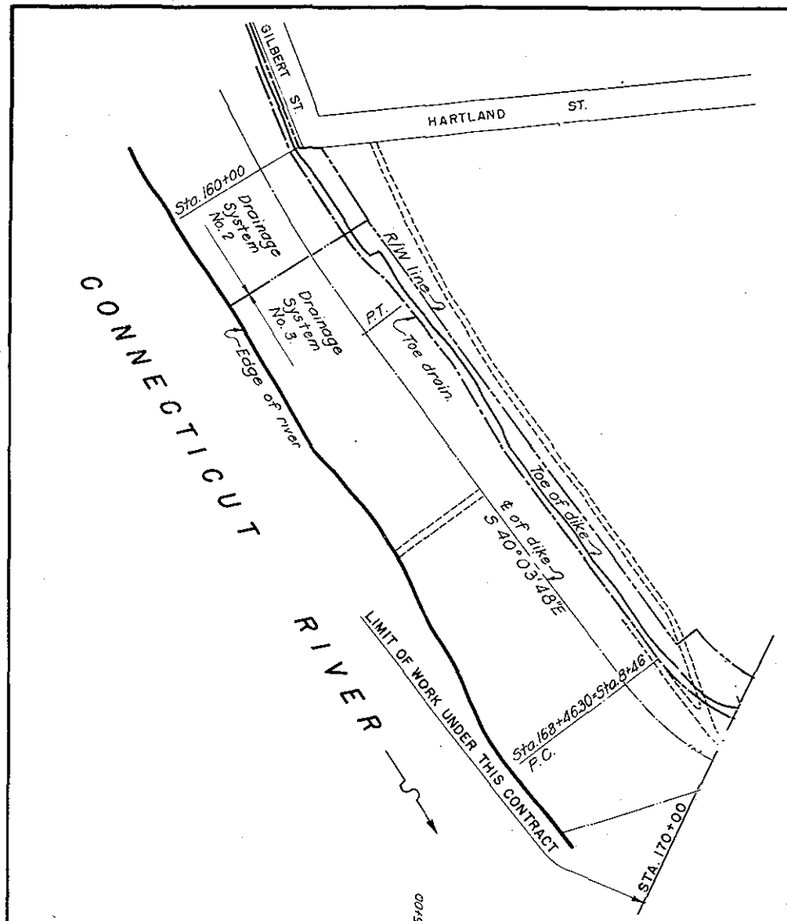
100' 0 100' 200

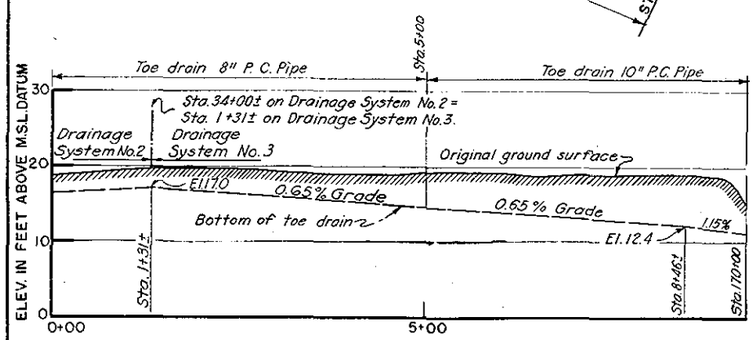
U. S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

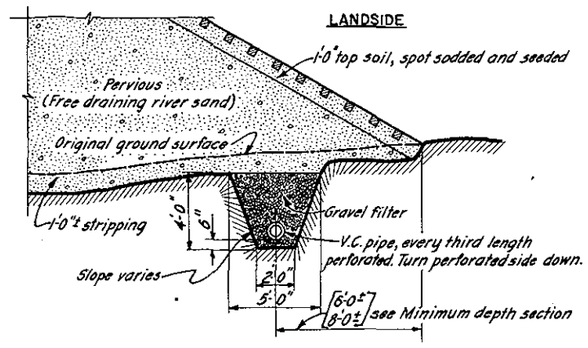
PLATE XVI



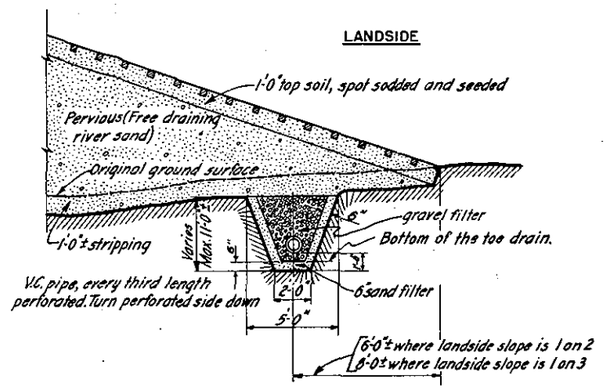


PROFILE ON ℄ TOE DRAIN

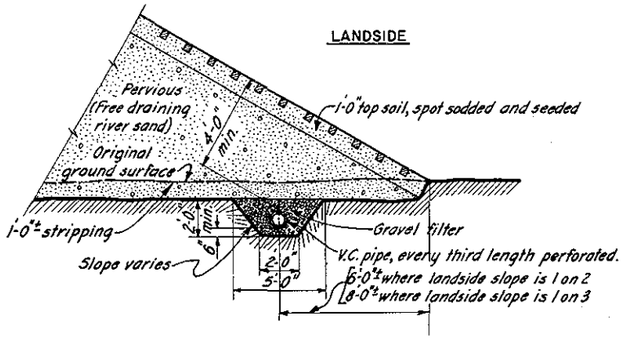
SCALE: HOR. 1" = 100'
VERT. 1" = 10'



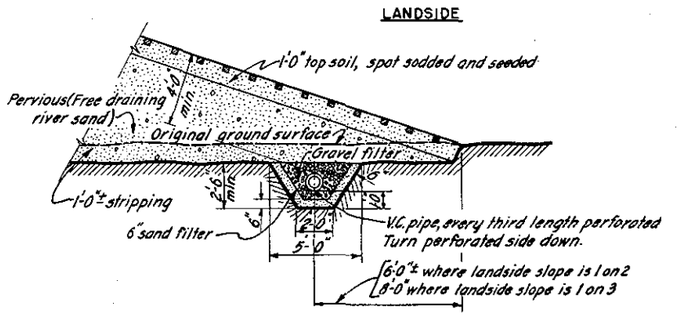
AVERAGE DEPTH



AVERAGE DEPTH

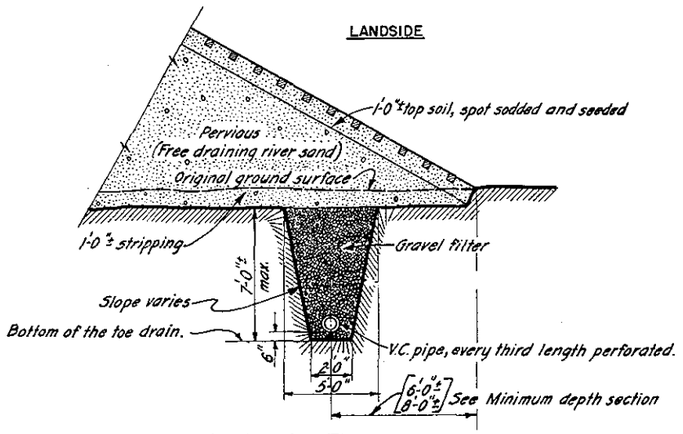


MINIMUM DEPTH



MINIMUM DEPTH

TYPE "B" DRAIN



MAXIMUM DEPTH

TYPE "A" DRAIN

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

DRAINAGE SYSTEM NO. 3

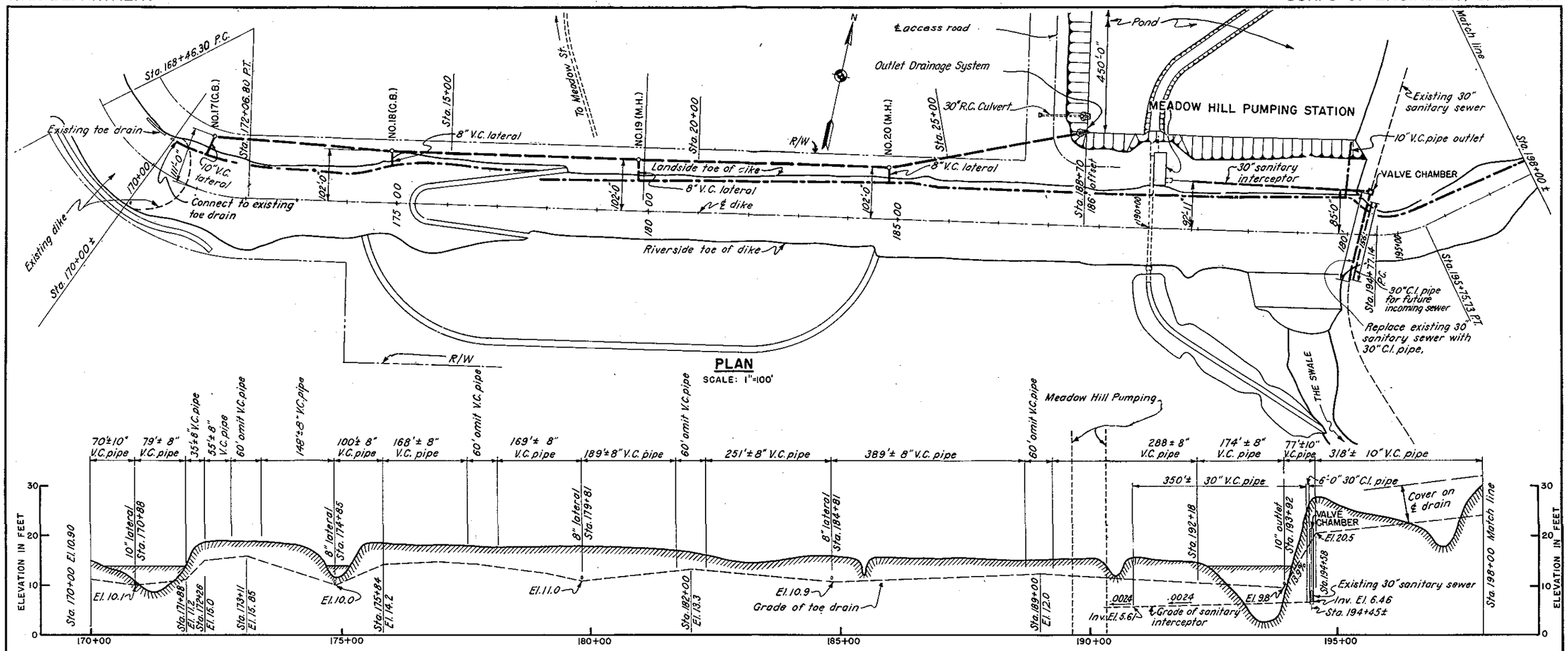
CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 100 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

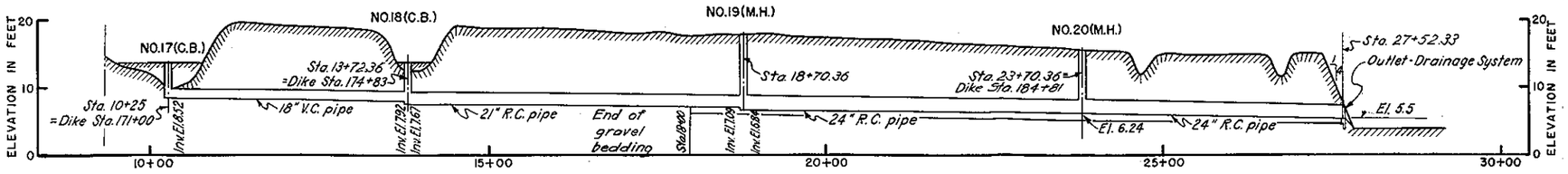
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD CONN



PROFILE ON ℄ TOE DRAIN

SCALE: HOR. 1"=100'
VERT. 1"=10'



PROFILE ON ℄ COLLECTOR DRAIN

SCALE: HOR. 1"=100'
VERT. 1" = 10'

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R & FROM STA. 170 ALONG HOCKANUM RIVER

DRAINAGE SYSTEM

PLAN AND PROFILE NO.1

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 100 FT.

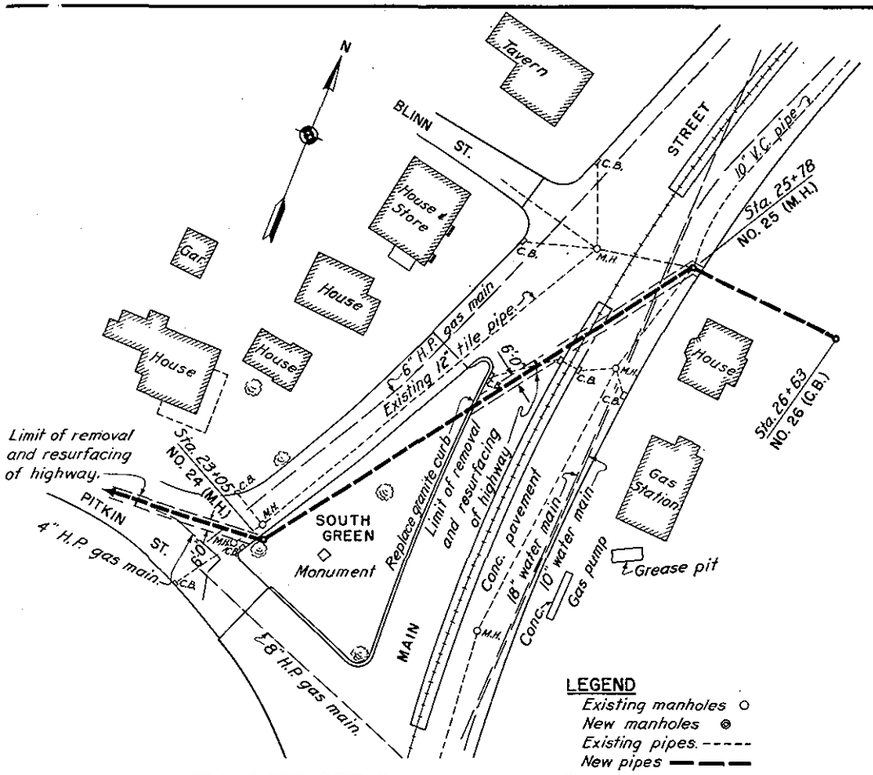
100' 0 100' 200'

U. S. ENGINEER OFFICE, PROVIDENCE, R. I., FEB. 1941

OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

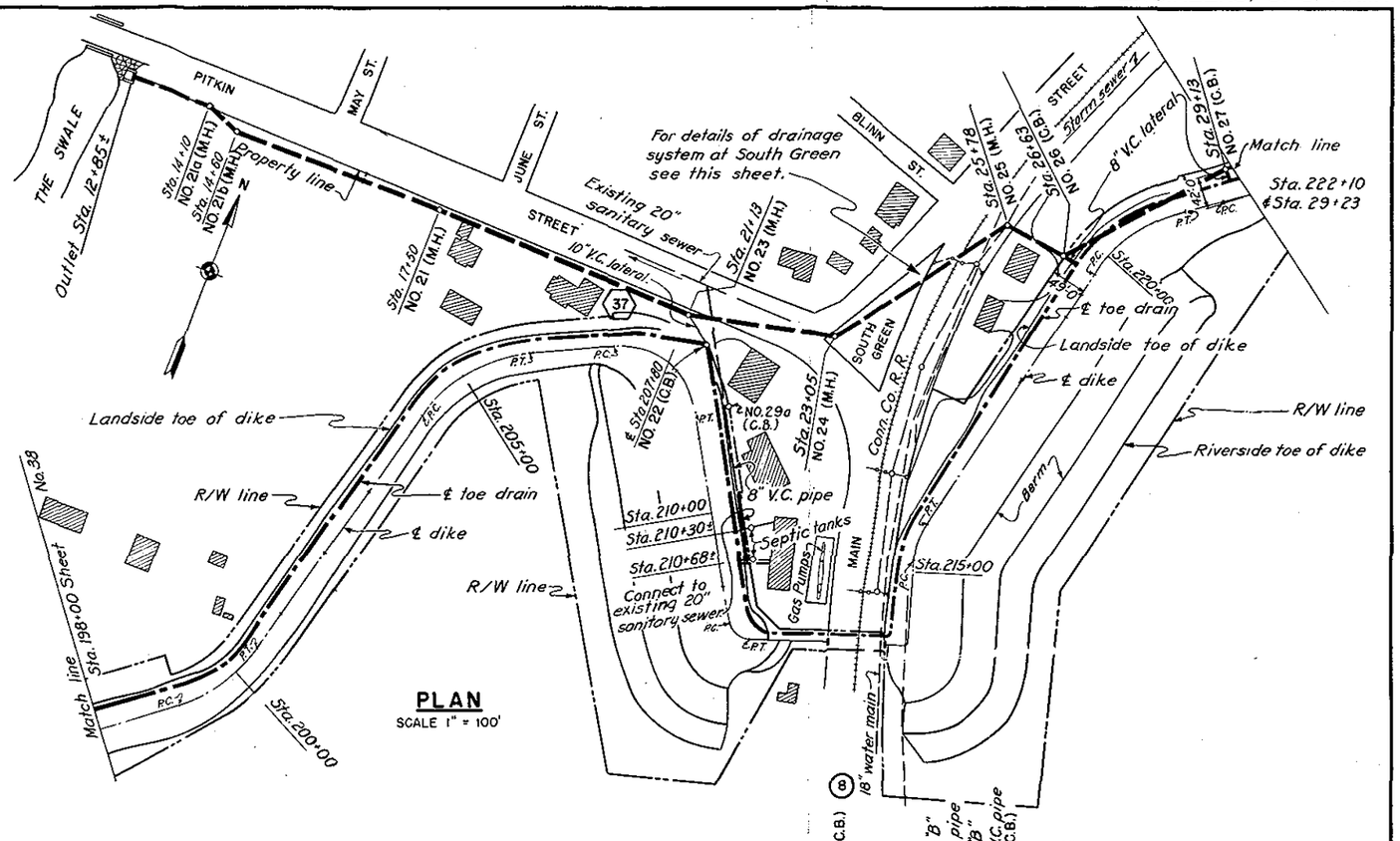
PLATE XVIII

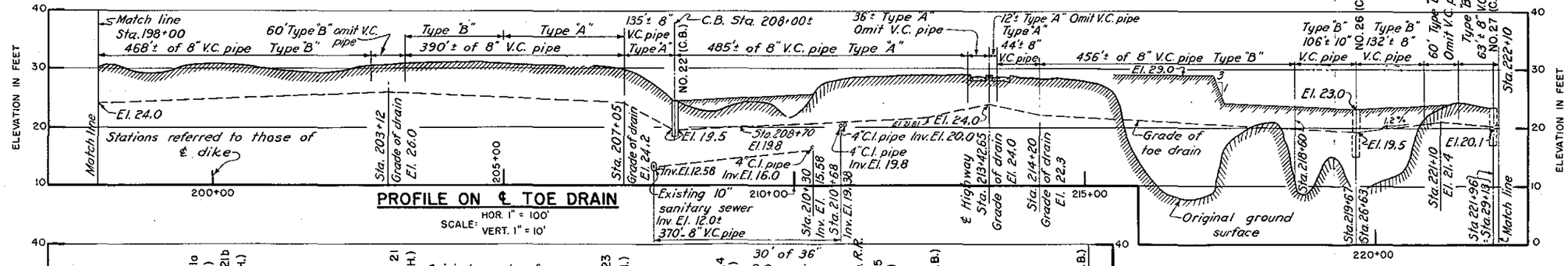


ENLARGED DETAIL AT SOUTH GREEN

SCALE 1" = 40'

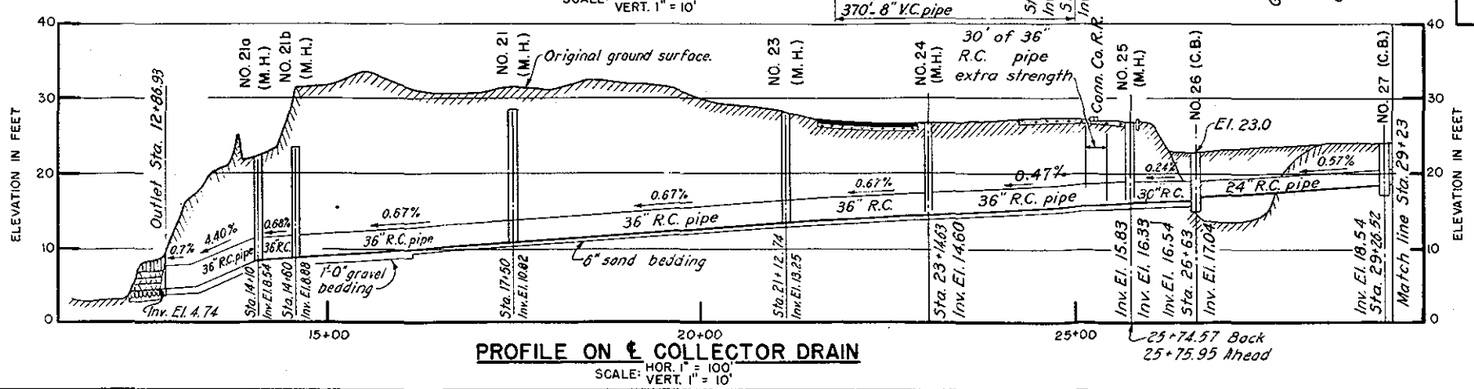
40 0 40 80





PROFILE ON ℄ TOE DRAIN

SCALE: HOR. 1" = 100'
VERT. 1" = 10'



PROFILE ON ℄ COLLECTOR DRAIN

SCALE: HOR. 1" = 100'
VERT. 1" = 10'

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

DRAINAGE SYSTEM

PLAN AND PROFILE NO. 2

CONNECTICUT RIVER — CONNECTICUT

SCALE 1 IN. = 100 FT.

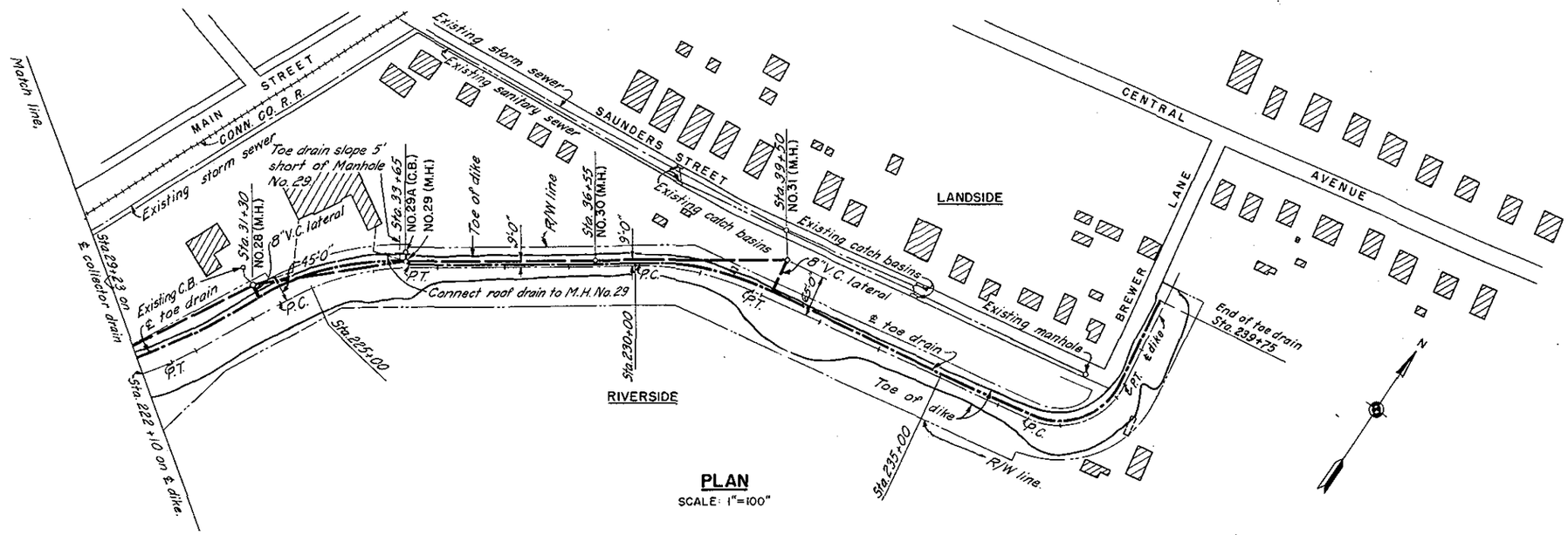
100' 0 100 200'

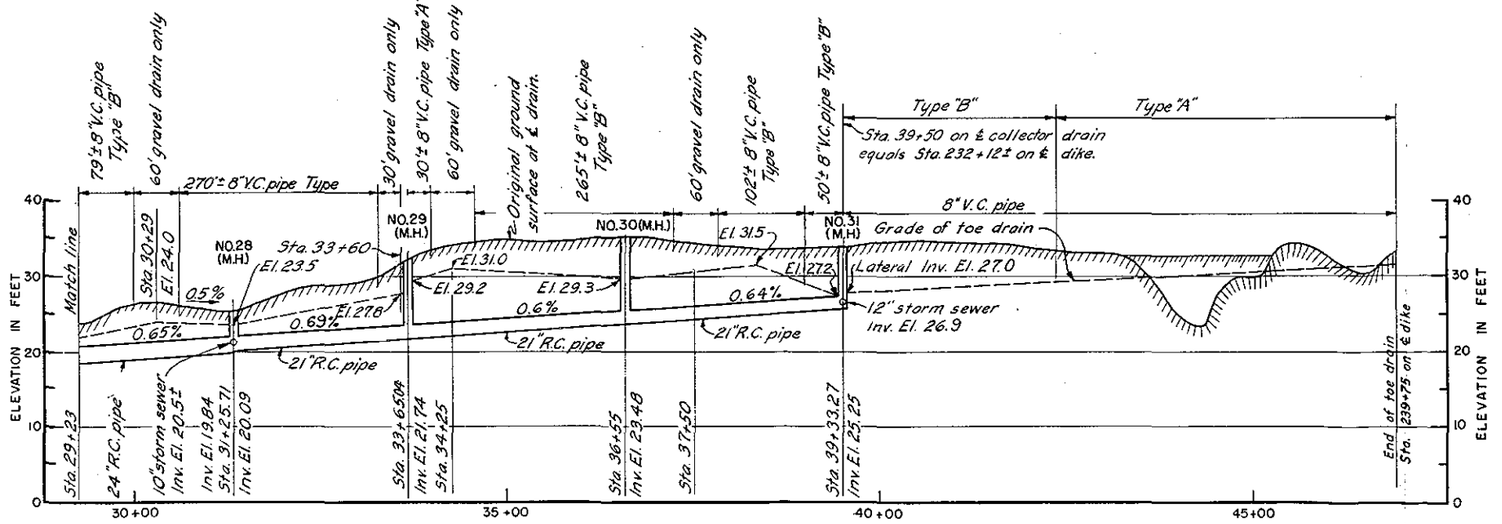
U. S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE XIX





PROFILE ON ℄ COLLECTOR DRAIN

SCALE: HOR. 1"=100'
VERT. 1"=10'

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

DRAINAGE SYSTEM
PLAN AND PROFILE NO.3

CONNECTICUT RIVER — CONNECTICUT

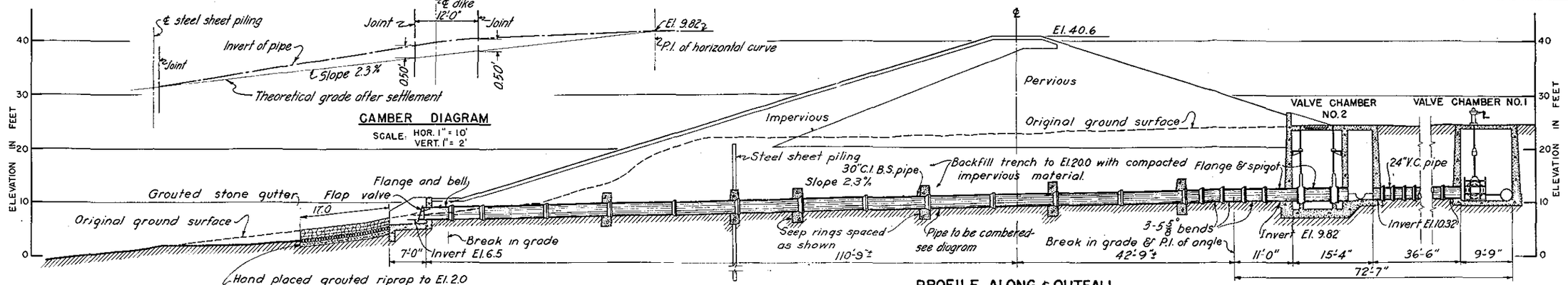
SCALE: 1 IN. = 100 FT.
100' 0 100' 200'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

OPERATION AND MAINTENANCE MANUAL

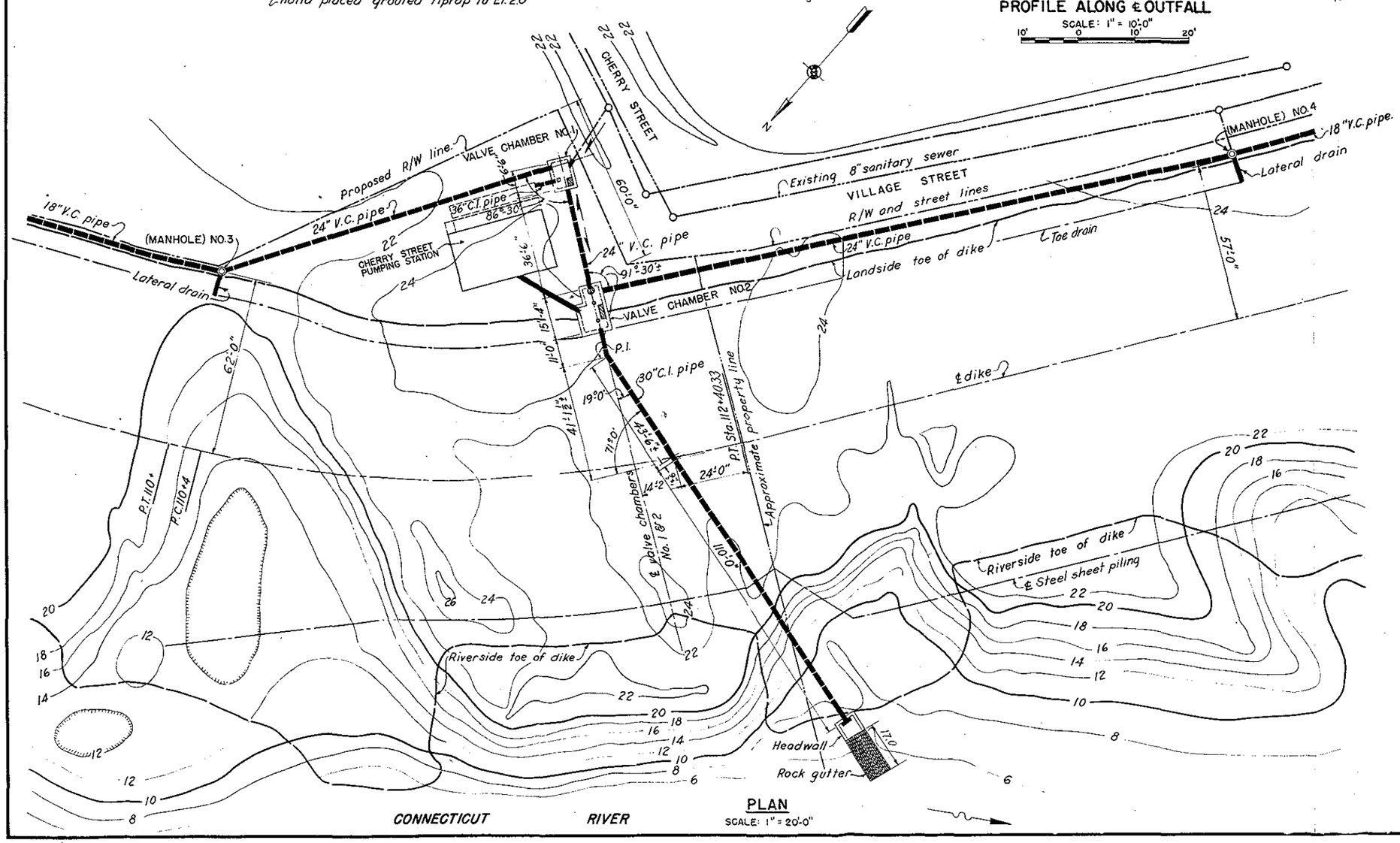
EAST HARTFORD, CONN.

PLATE XX



PROFILE ALONG ℄ OUTFALL

SCALE: 1" = 10'-0"



NOTES

Contour interval 2 feet.
Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

CHERRY STREET OUTFALL

PLAN AND PROFILE

CONNECTICUT RIVER — CONNECTICUT

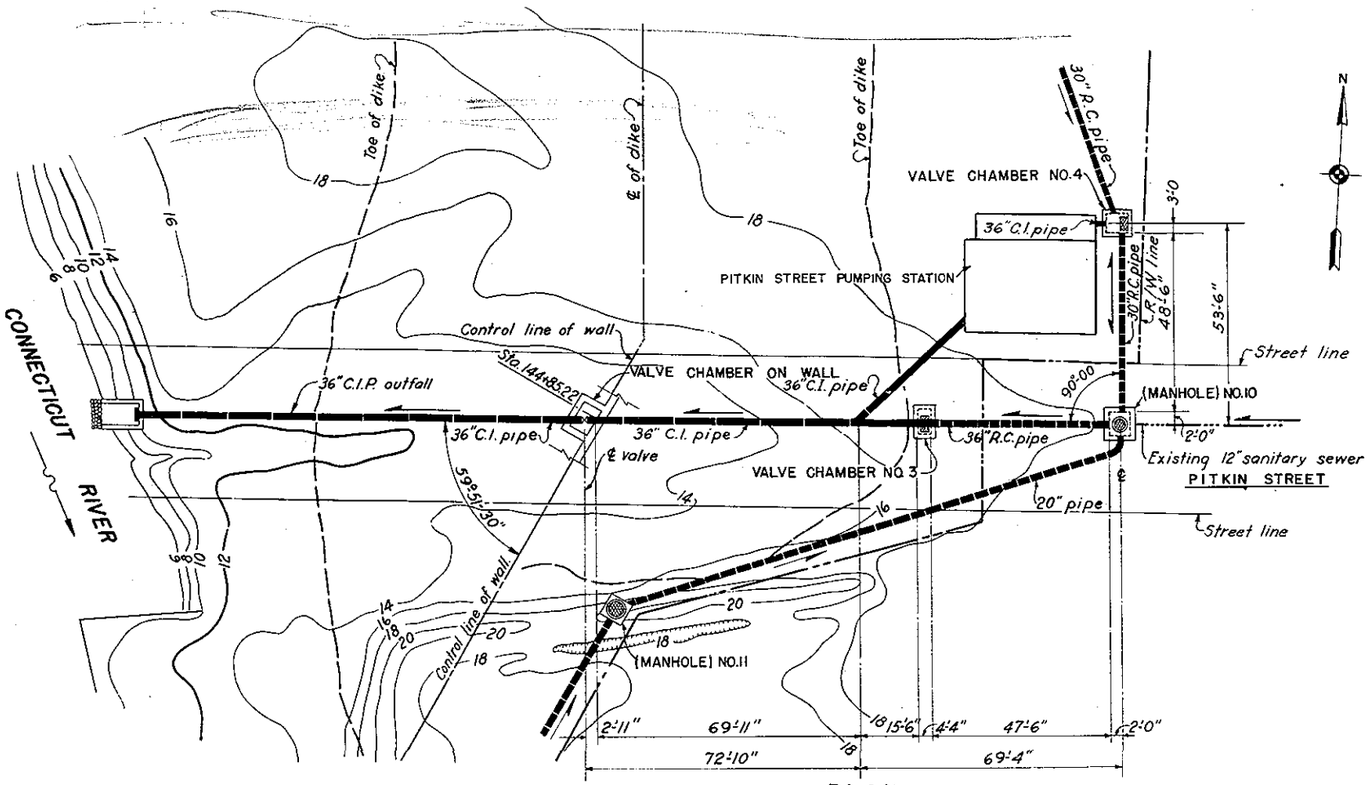
SCALE: 1 IN. = 20 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

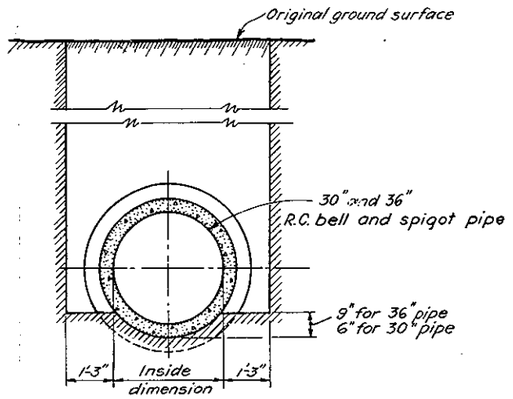
EAST HARTFORD, CONN.

PLATE XXI



PLAN

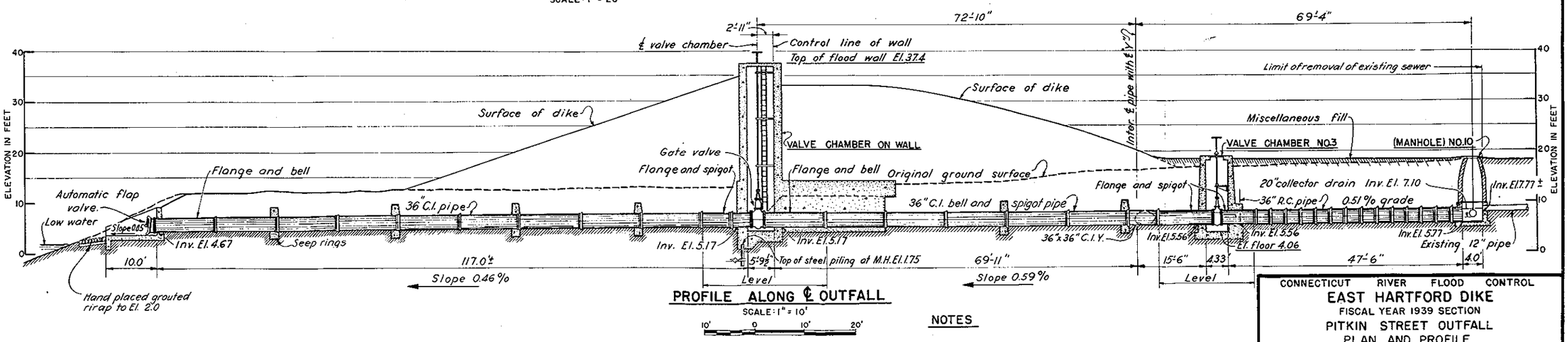
SCALE: 1" = 20'



LAYING DETAILS R.C. PIPE

SCALE: ½" = 1'-0"

1' 0 1' 2' 3' 4' 5'



PROFILE ALONG ℄ OUTFALL

SCALE: 1" = 10'

10' 0 10' 20'

NOTES

Elevations refer to Mean Sea Level Datum.
Contour interval 2 feet.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

PITKIN STREET OUTFALL

PLAN AND PROFILE

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1 IN. = 20 FT.

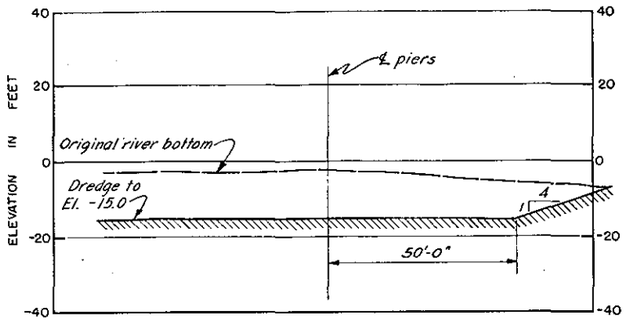
20' 0 20' 40'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

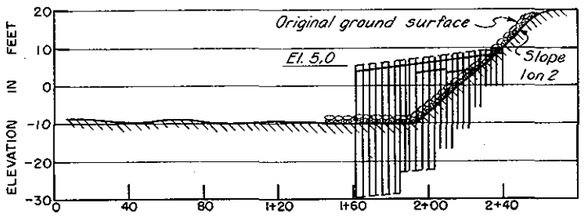
EAST HARTFORD, CONN.

PLATE XXII

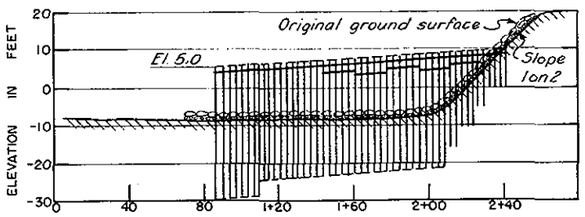


SECTION G

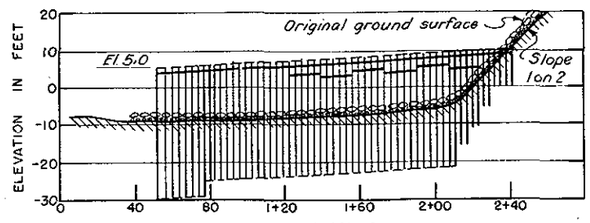
SCALE: 1" = 20'



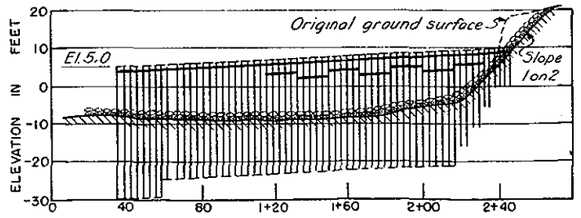
SECTION A



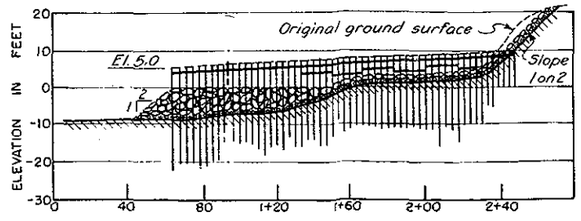
SECTION B



SECTION C



SECTION D



SECTION E

SECTIONS ALONG ℄ GROINS

SCALE: HOR. 1" = 40'
VERT. 1" = 20'

PLAN

SCALE: 1" = 200'

SCHEDULE OF PILES

NO. OF PILES	APPROX. LENGTH IN FEET	AVER. PENE-TRA.	REMARKS
20	10	7	
10	15	8	
12	20	10	
10	25	13	
180	30	15	
95	35	20	Including batter piles at clumps

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

NORTH OF R.R. & FROM STA. 170 ALONG HOCKANUM RIVER

PROTECTION OF RIVER BED AND BANK

GENERAL PLAN AND SECTIONS

CONNECTICUT RIVER CONNECTICUT

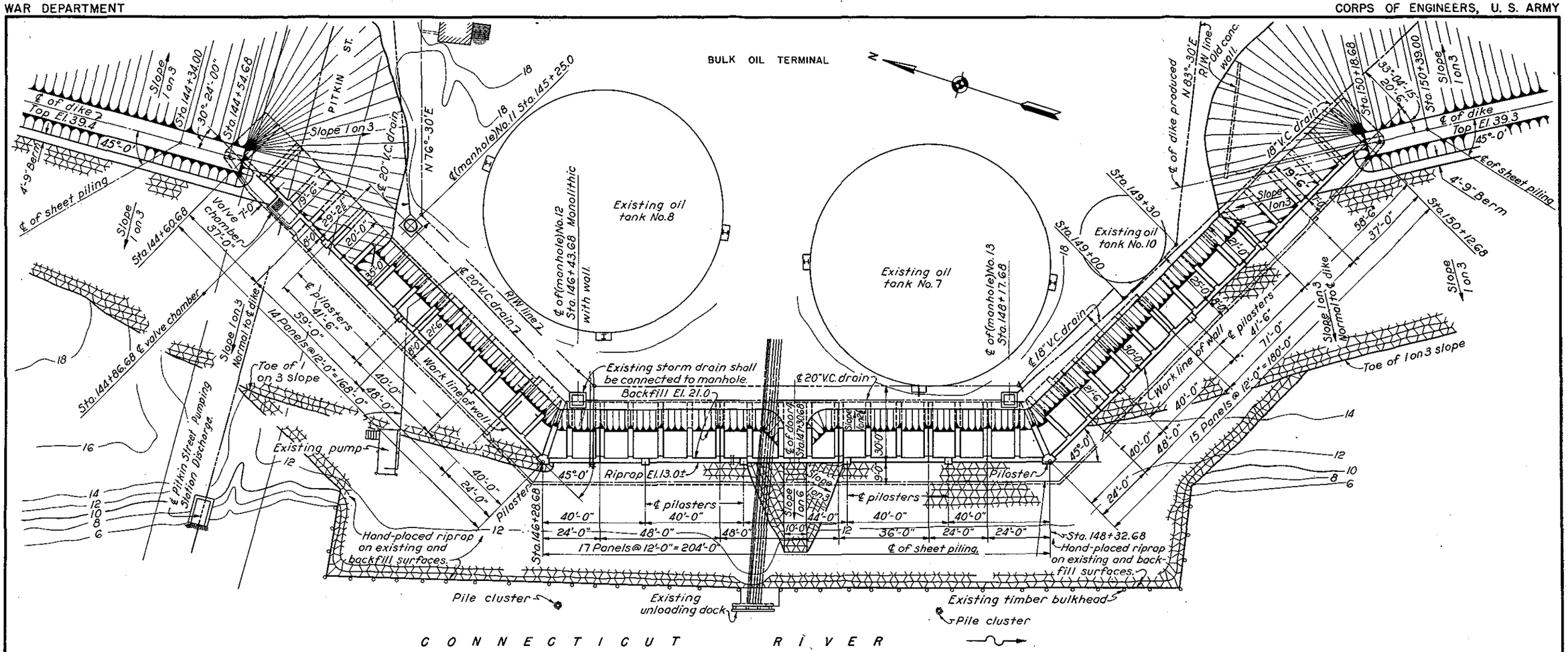
SCALE: 1IN. = 200 FT.

200' 0 200' 400'

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

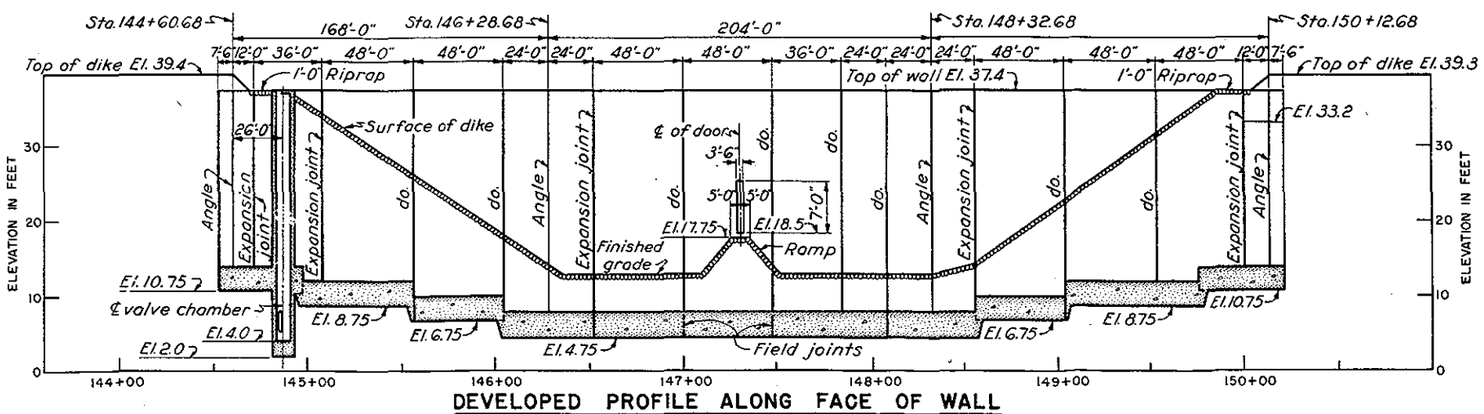
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.



PLAN

SCALE 1" = 20'



DEVELOPED PROFILE ALONG FACE OF WALL

SCALE: HOR. 1" = 40'
VERT. 1" = 10'

NOTES

Elevations refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

CONCRETE FLOODWALL

PLAN AND PROFILE

CONNECTICUT RIVER — CONNECTICUT

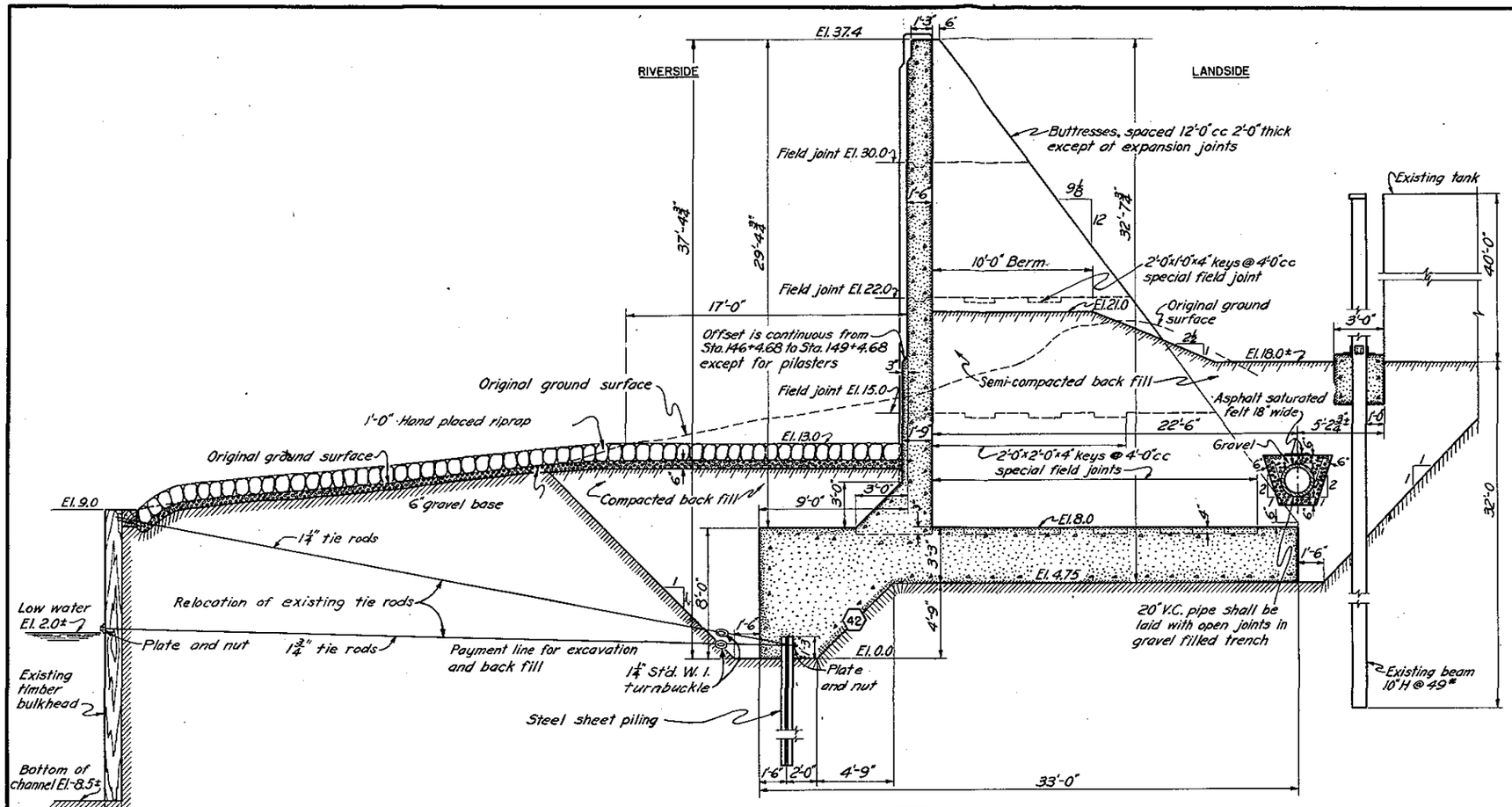
SCALE: 1 IN. = 2 0 FT. 20' 0 20' 40'

U. S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

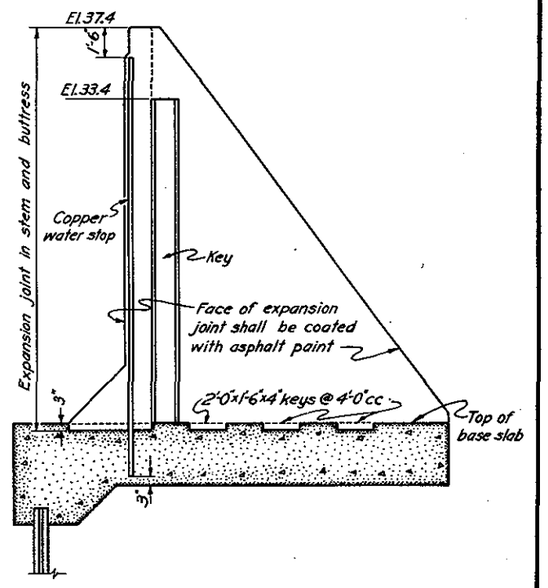
EAST HARTFORD, CONN.

PLATE XXIV



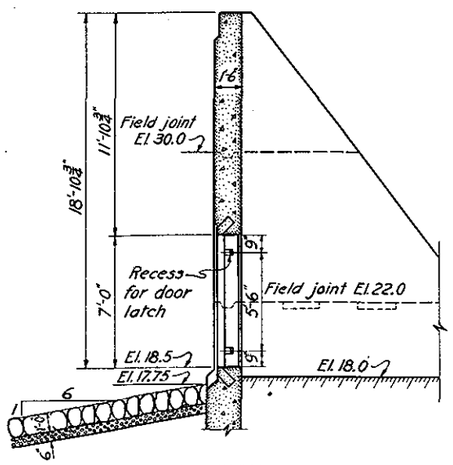
SECTION

SCALE 1" = 1'-0"



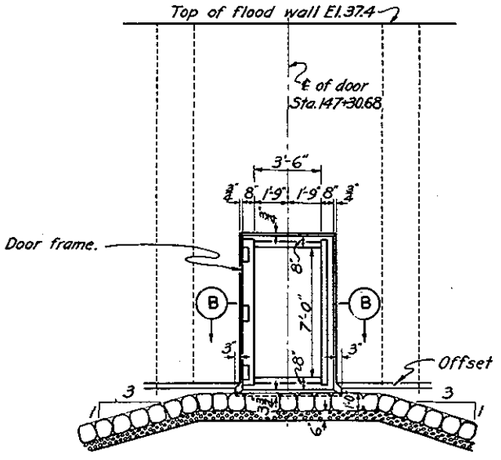
TYPICAL DETAIL AT EXPANSION JOINTS

SCALE 1" = 1'-0"



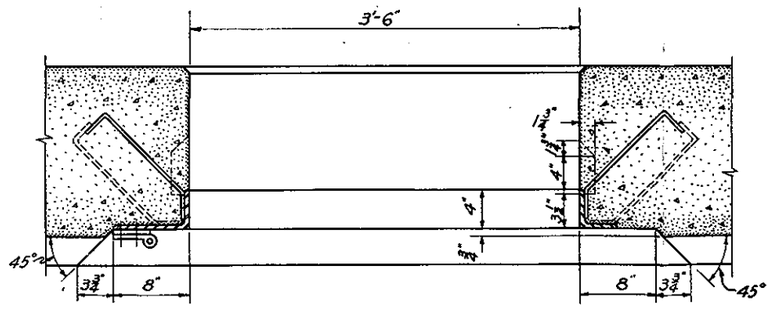
SECTION A

SCALE 1" = 1'-0"



DETAIL OF DOOR OPENING

SCALE 1" = 1'-0"



SECTION B

SCALE 1½" = 1'-0"

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

FISCAL YEAR 1939 SECTION

CONCRETE FLOODWALL DETAILS NO. I

CONNECTICUT RIVER — CONNECTICUT

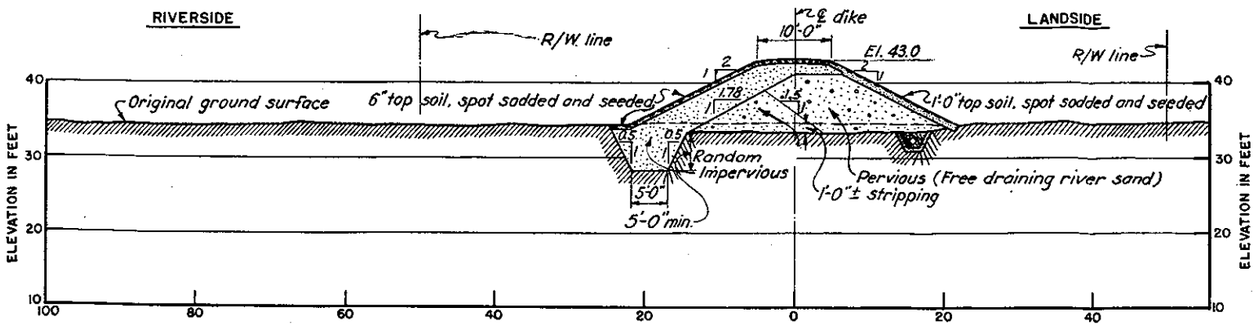
SCALE: 1/4 IN. = 1 FT.

U.S. ENGINEER OFFICE, PROVIDENCE, R.I., MARCH 1939

OPERATION AND MAINTENANCE MANUAL

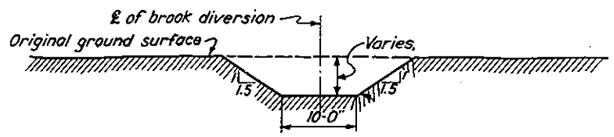
EAST HARTFORD, CONN.

PLATE XXV



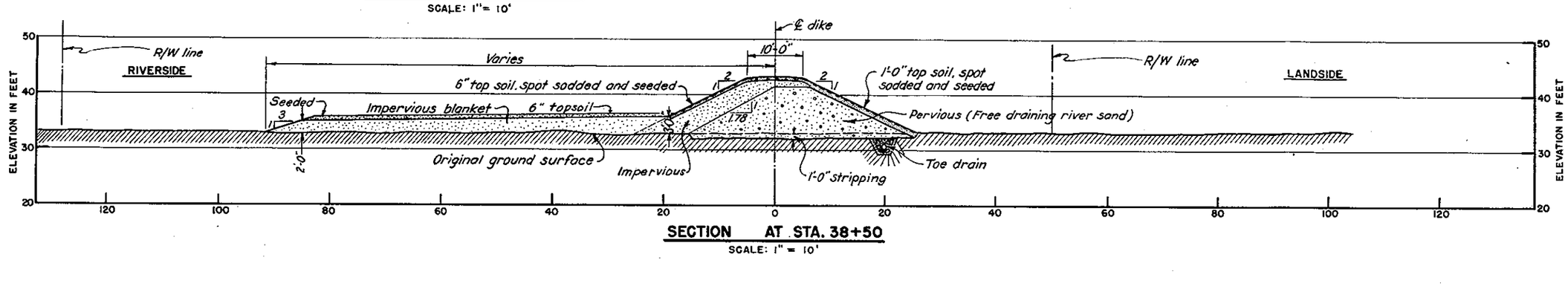
SECTION AT STA. 36+00

SCALE: 1" = 10'



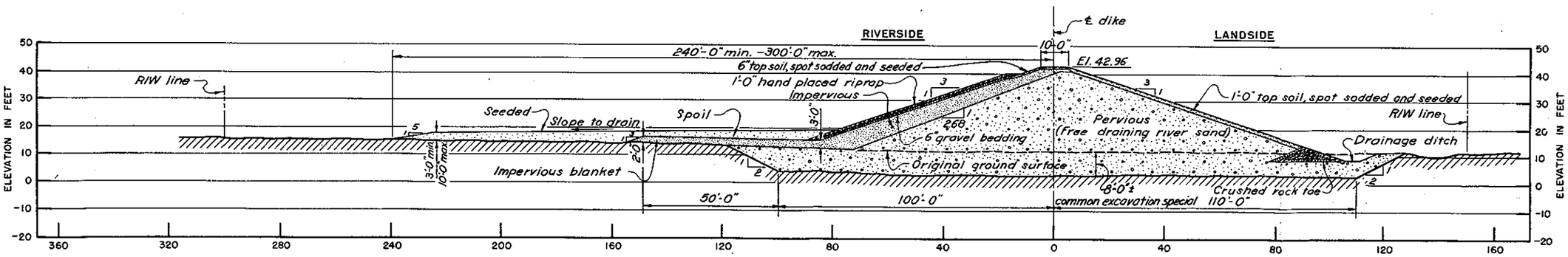
TYPICAL DETAIL OF BROOK DIVERSION

SCALE 1" = 10'



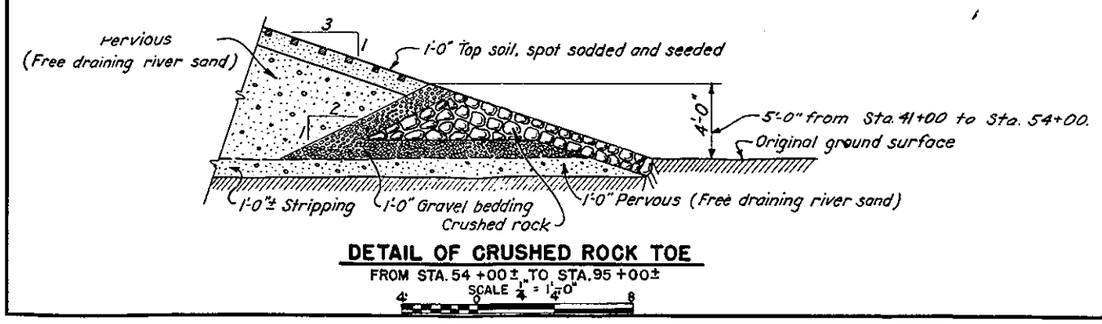
SECTION AT STA. 38+50

SCALE: 1" = 10'



SECTION AT STA. 52+00

SCALE: 1" = 20'



DETAIL OF CRUSHED ROCK TOE

FROM STA. 54+00± TO STA. 95+00±

SCALE 1/4" = 1'-0"

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

EMBANKMENT DETAILS NO. 1

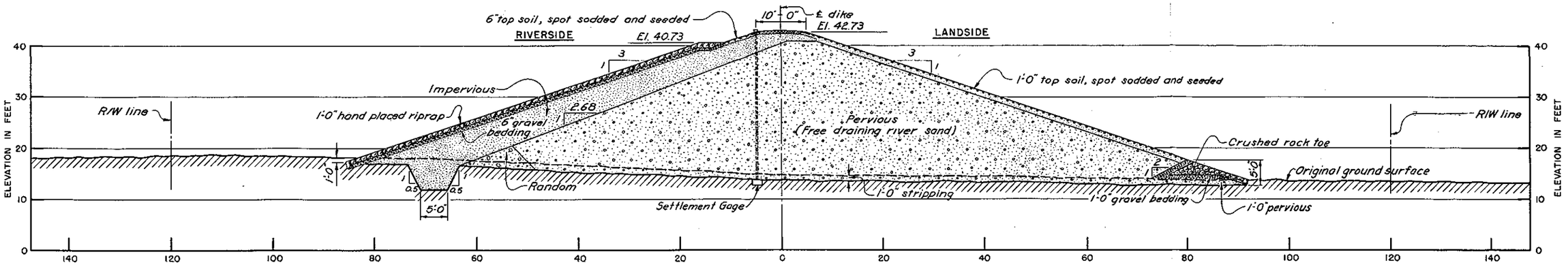
CONNECTICUT RIVER — CONNECTICUT

SCALE 1 IN. = 10 FT.

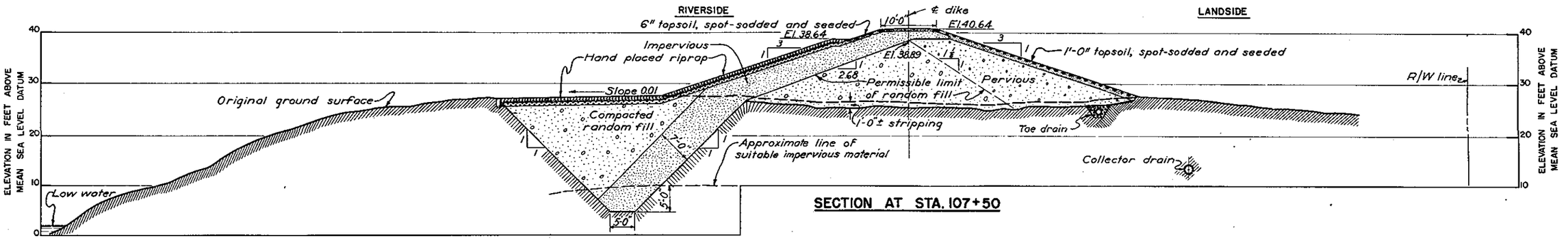
U. S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

OPERATION AND MAINTENANCE MANUAL

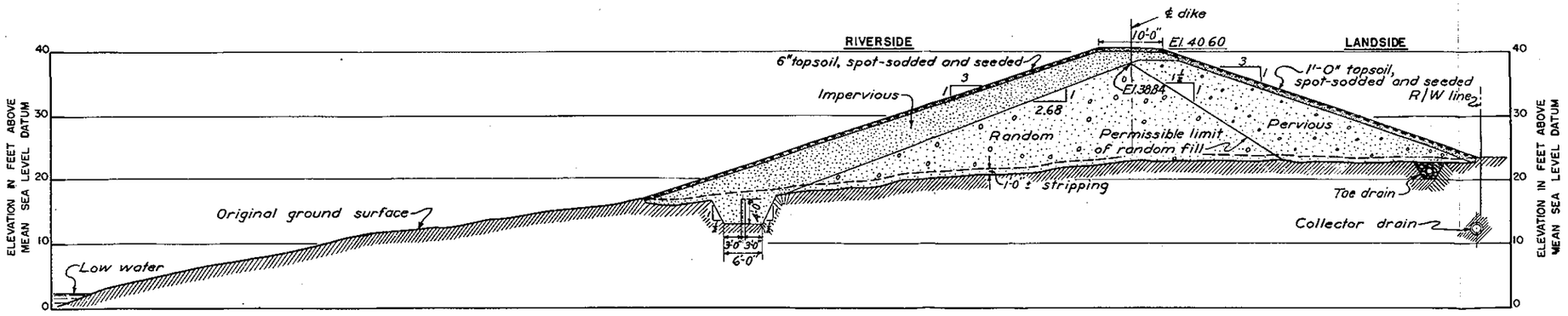
EAST HARTFORD, CONN.



SECTION AT STA. 75+00



SECTION AT STA. 107+50



SECTION AT STA. 113+00

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

EMBANKMENT DETAILS NO. 2

CONNECTICUT RIVER — CONNECTICUT

SCALE 1 IN. = 10 FT.

U. S. ENGINEER OFFICE, PROVIDENCE, R. I., MARCH 1939

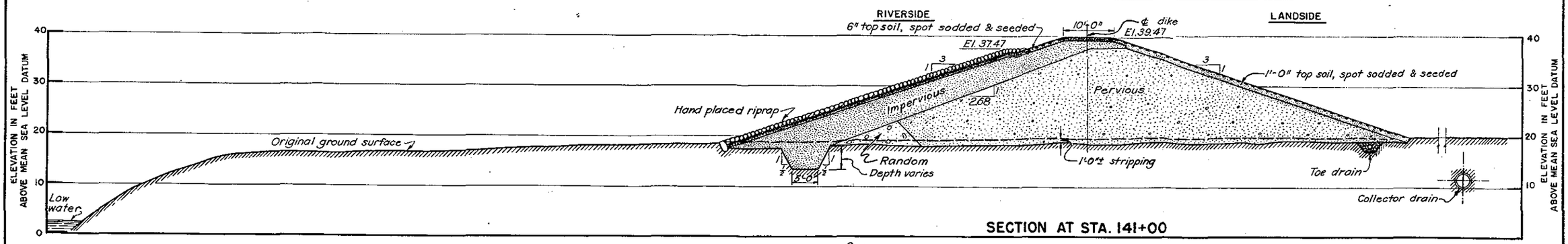
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

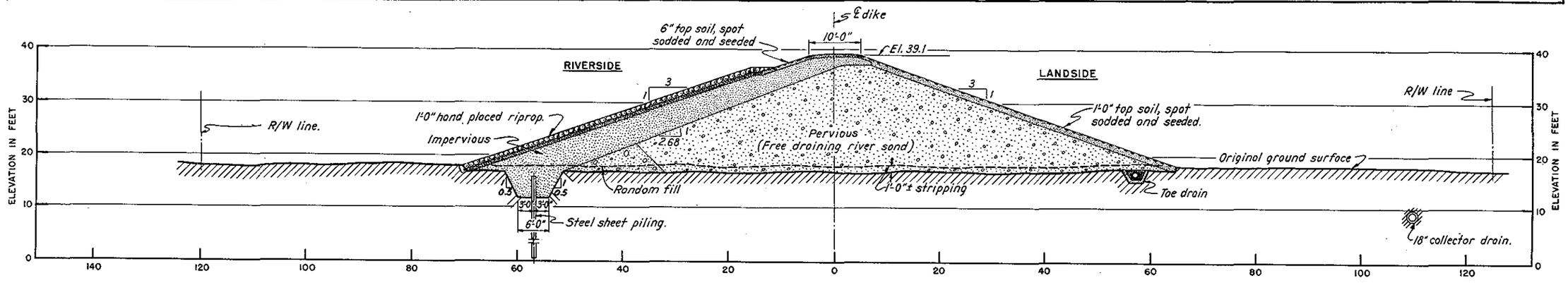
PLATE NO. XXVII

WAR DEPARTMENT

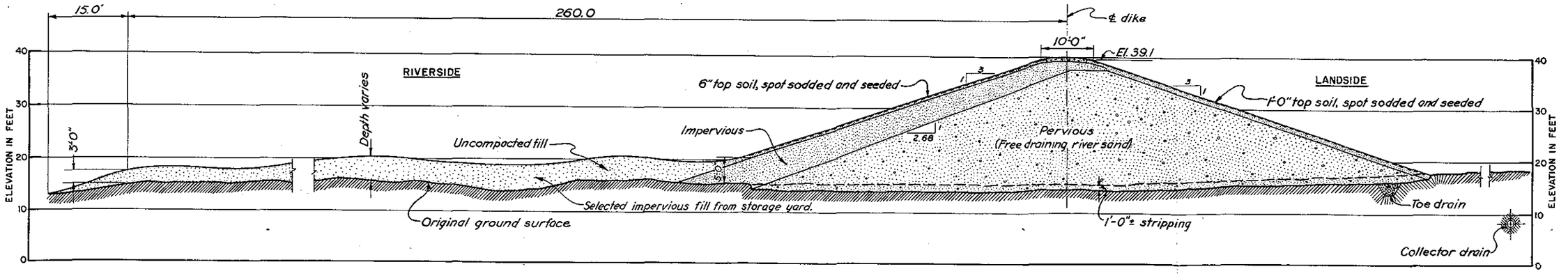
CORPS OF ENGINEERS, U. S. ARMY



SECTION AT STA. 141+00



SECTION AT STA. 173+00



SECTION AT STA. 181+00

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

EMBANKMENT DETAILS NO. 3

CONNECTICUT RIVER — CONNECTICUT

SCALE 1 IN. = 10 FT.

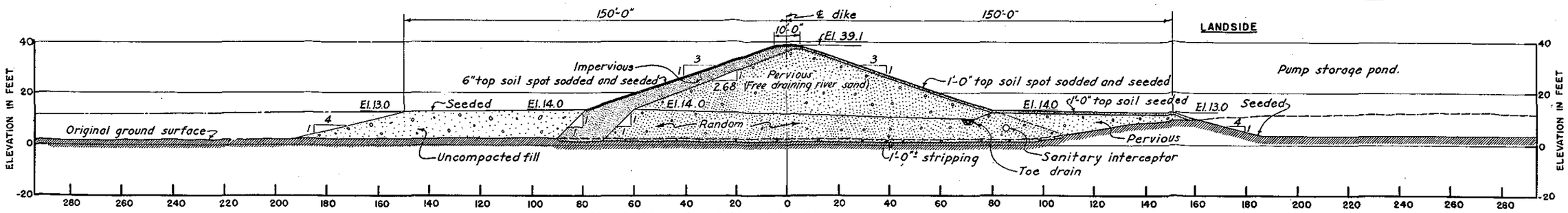
10' 0 10' 20'

U.S. ENGINEER OFFICE. PROVIDENCE, R.I., FEB. 1941

OPERATION AND MAINTENANCE MANUAL

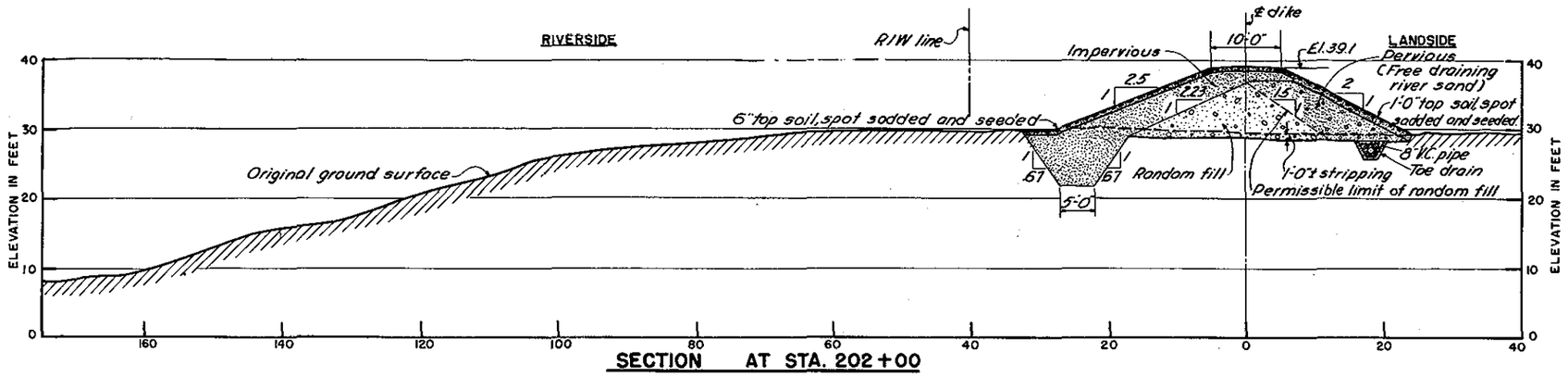
EAST HARTFORD, CONN.

PLATE NO. XXVIII

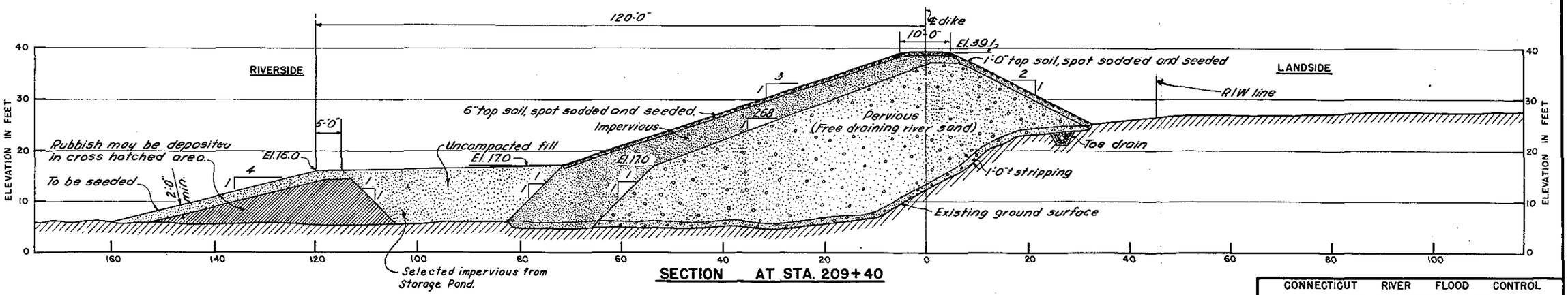


SECTION AT STA. 193+60

SCALE 1" = 20'



SECTION AT STA. 202+00



SECTION AT STA. 209+40

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

EMBANKMENT DETAILS NO. 4

CONNECTICUT RIVER — CONNECTICUT

SCALE 1 IN. = 10 FT.

U. S. ENGINEER OFFICE, PROVIDENCE, R.I., FEB. 1941

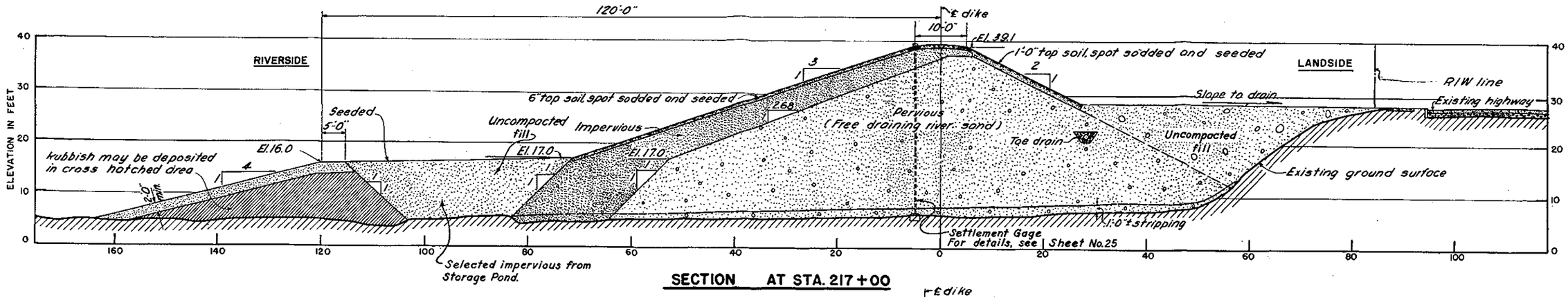
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

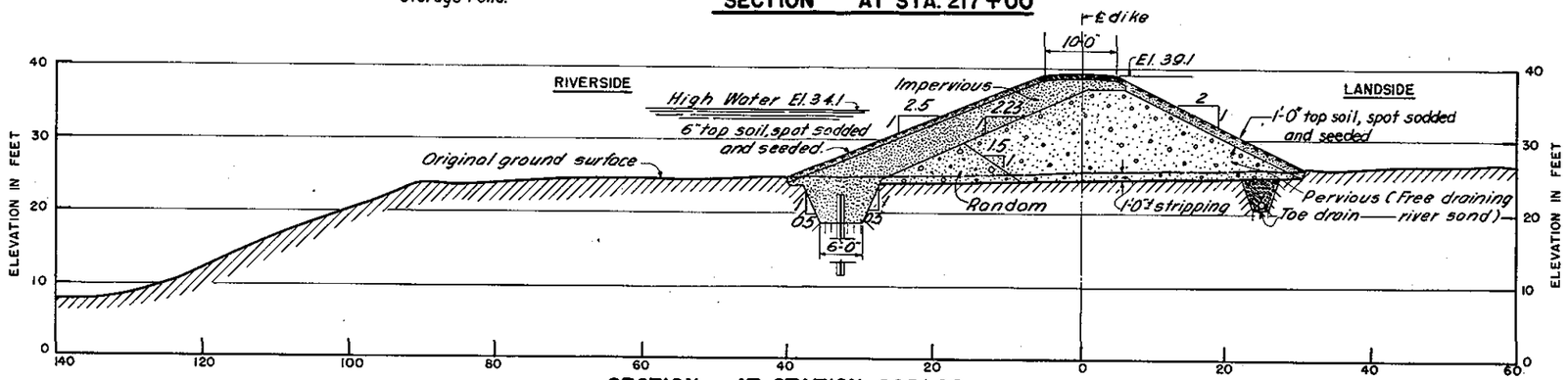
PLATE NO. XXIX

WAR DEPARTMENT

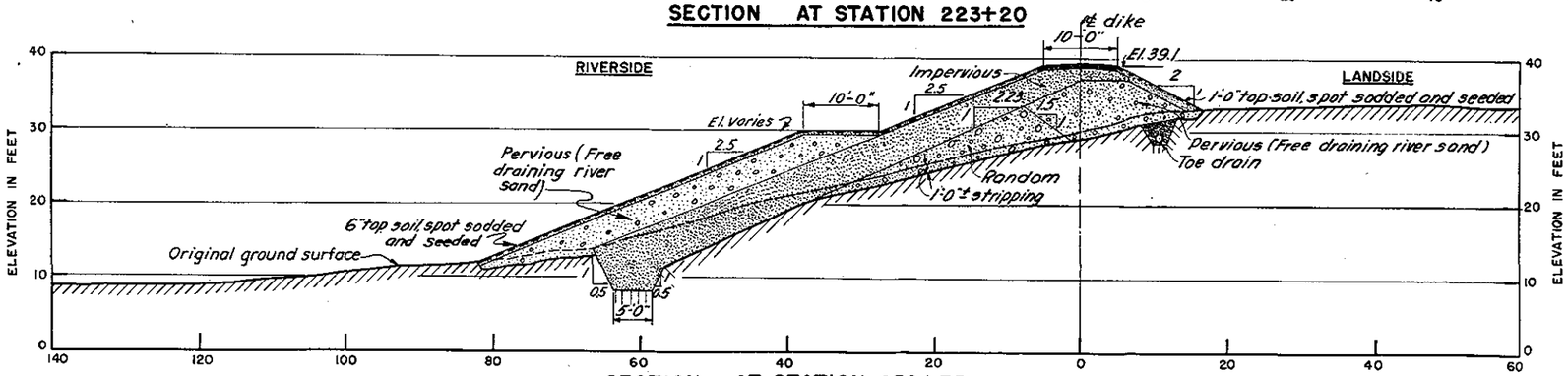
CORPS OF ENGINEERS, U. S. ARMY



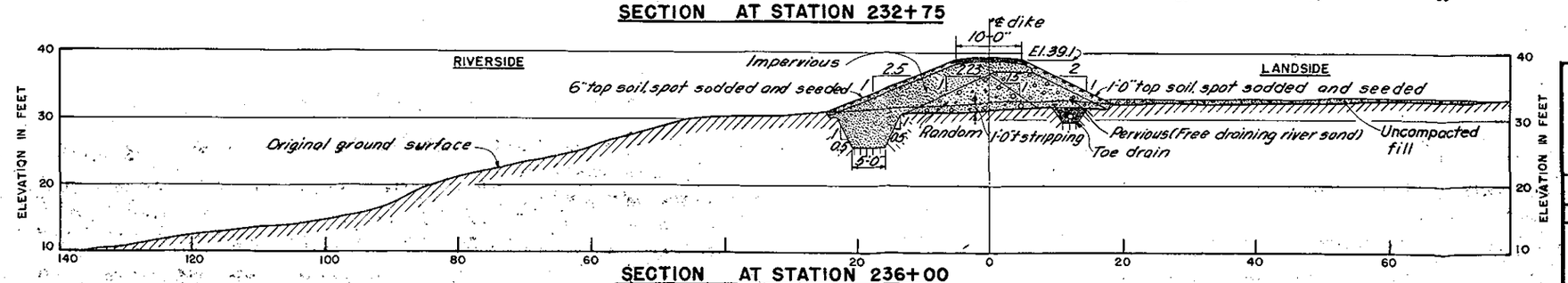
SECTION AT STA. 217+00



SECTION AT STATION 223+20



SECTION AT STATION 232+75



SECTION AT STATION 236+00

CONNECTICUT RIVER FLOOD CONTROL

EAST HARTFORD DIKE

EMBANKMENT DETAILS NO. 5

CONNECTICUT RIVER — CONNECTICUT

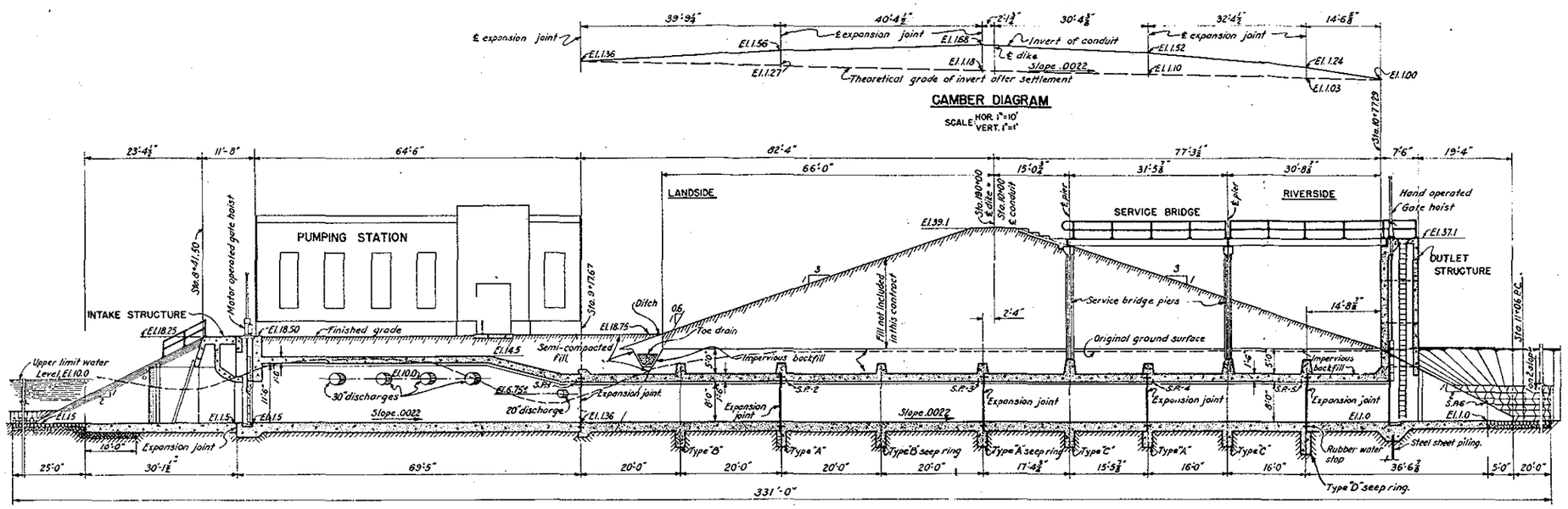
SCALE 1" = 10'

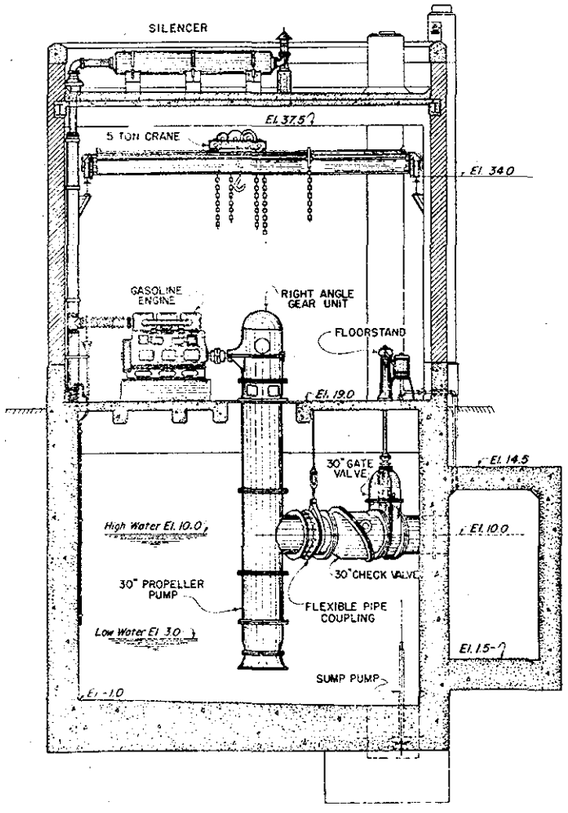
U.S. ENGINEER OFFICE PROVIDENCE R.I. MARCH 1939

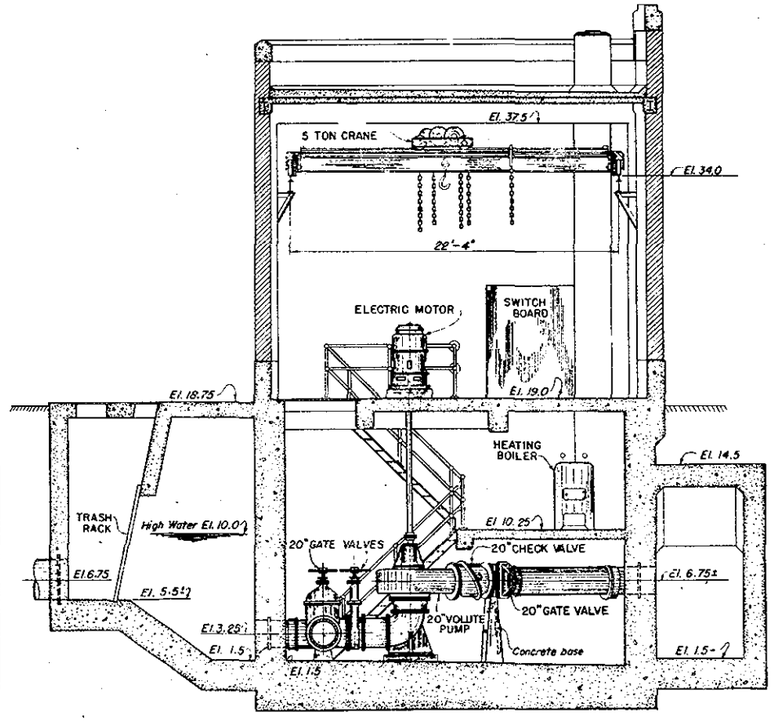
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD CONN

PLATE NO. XXX







NOTE

Elevations shown refer to Mean Sea Level Datum.

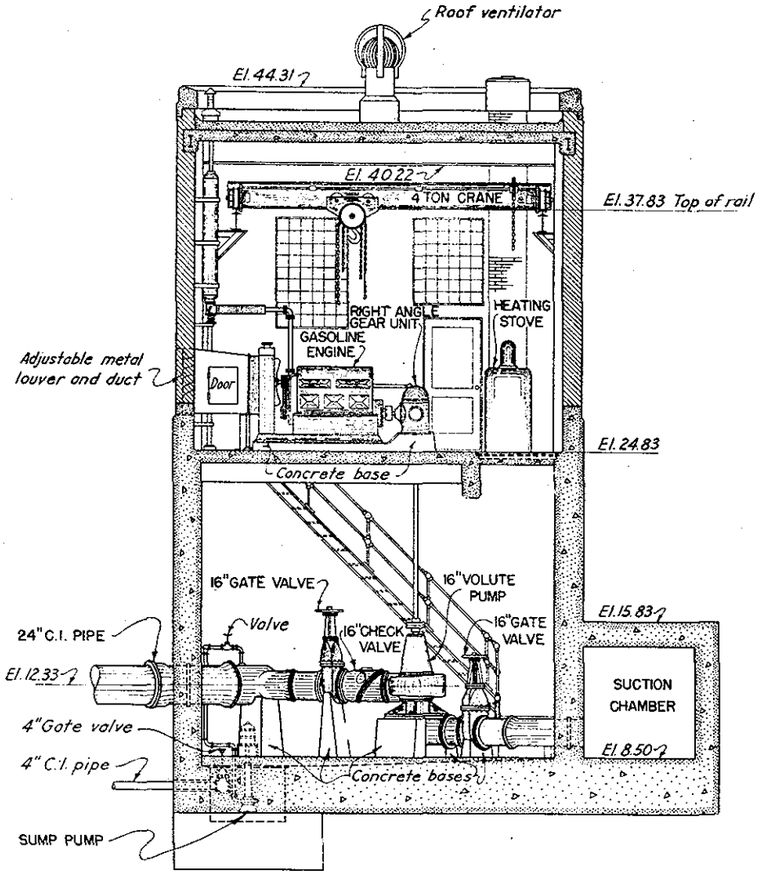
CONNECTICUT RIVER FLOOD CONTROL
MEADOW HILL PUMPING STATION
EAST HARTFORD, CONN.

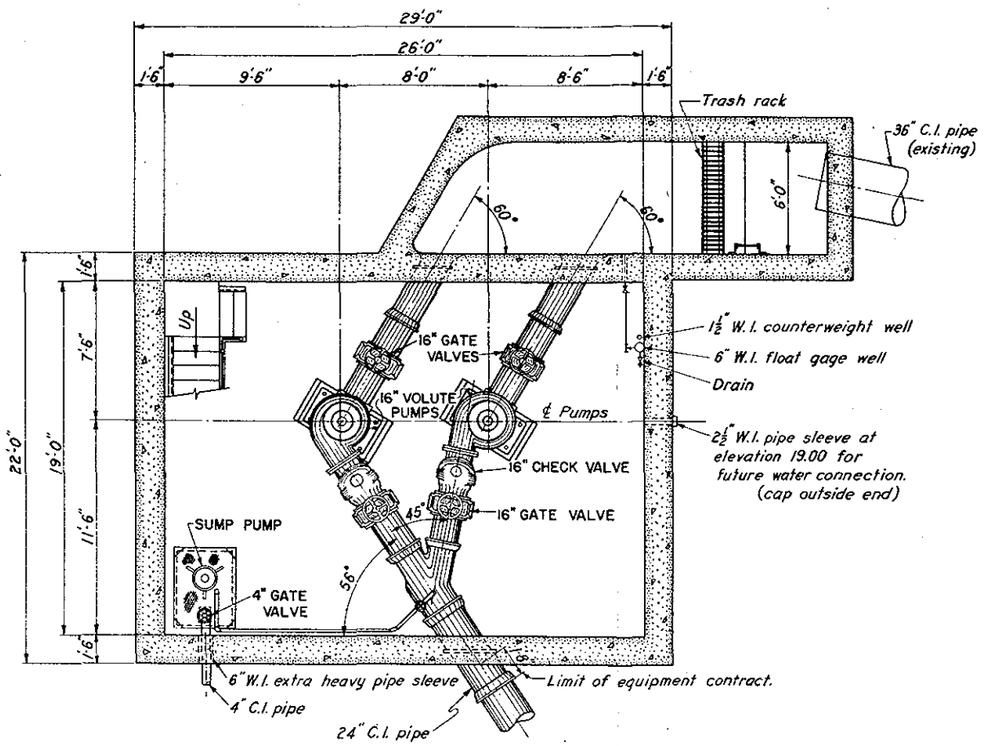
CONNECTICUT RIVER — CONNECTICUT

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.

OPERATION AND MAINTENANCE MANUAL
EAST HARTFORD, CONN.

PLATE XXXI





PUMP ROOM PLAN

NOTE

Elevations shown refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

CHERRY STREET PUMPING STATION

EAST HARTFORD, CONN.

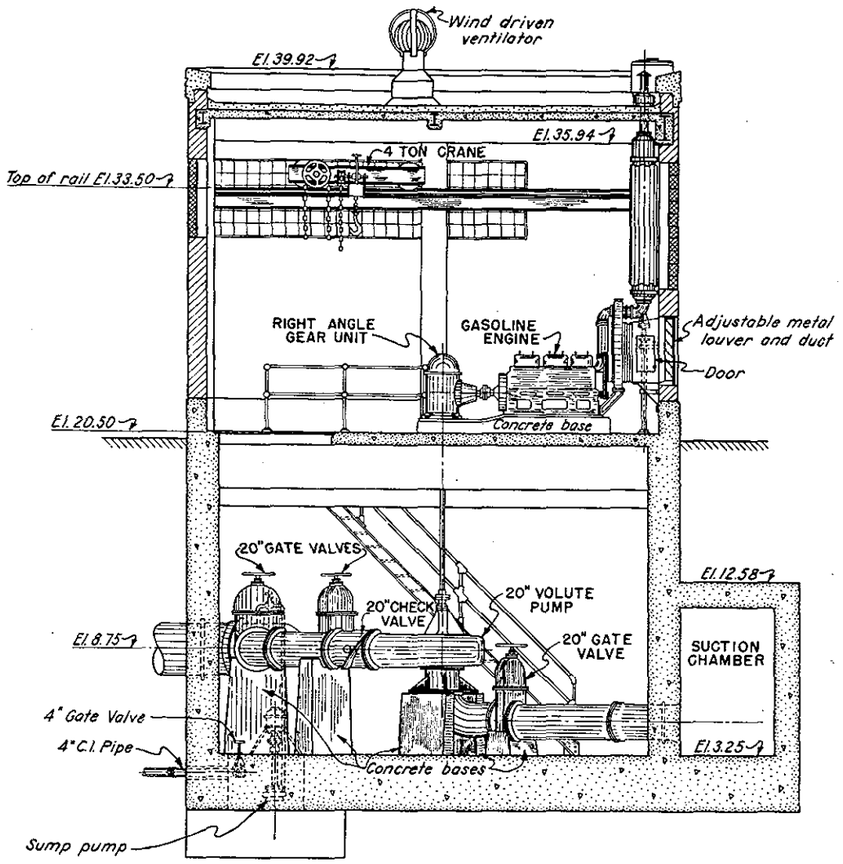
CONNECTICUT RIVER — CONNECTICUT

U.S. ENGINEER OFFICE, PROVIDENCE, R.I.,

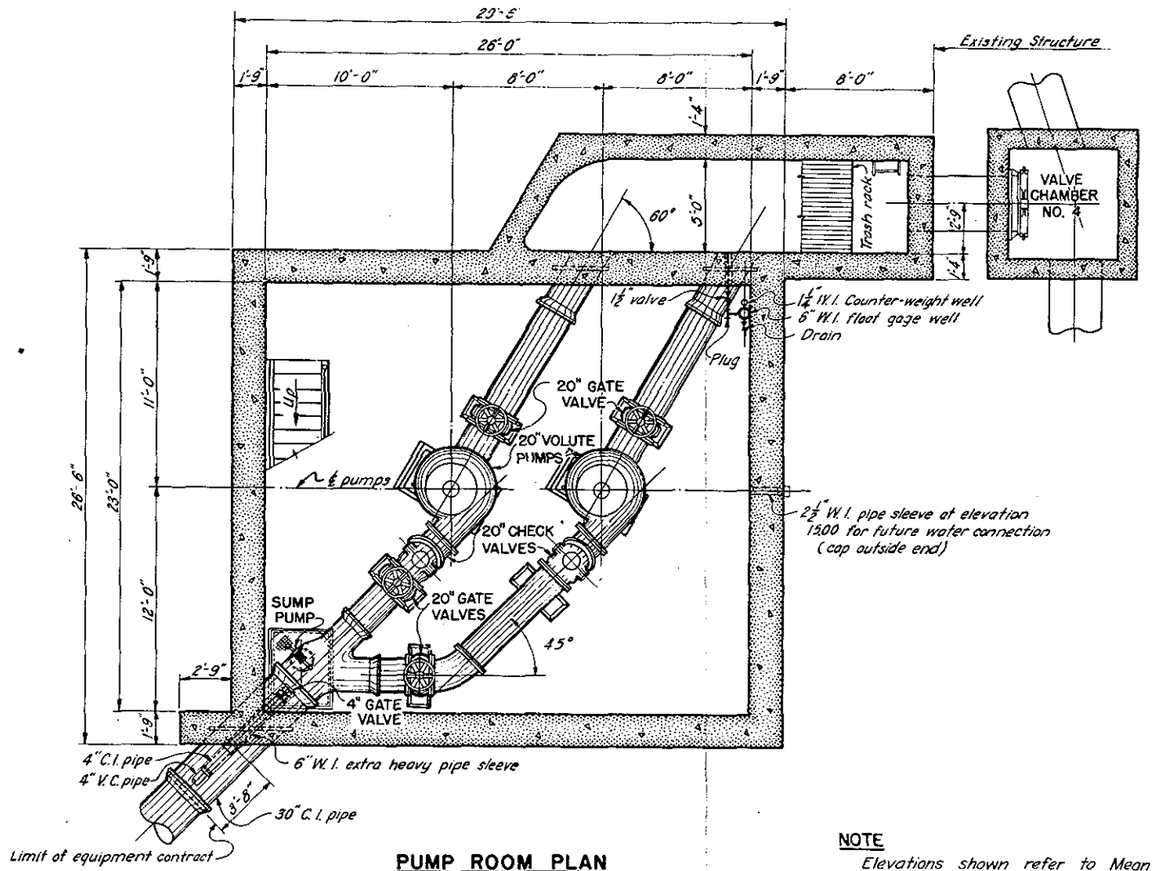
OPERATION AND MAINTENANCE MANUAL

EAST HARTFORD, CONN.

PLATE XXXII



SECTION



PUMP ROOM PLAN

NOTE

Elevations shown refer to Mean Sea Level Datum.

CONNECTICUT RIVER FLOOD CONTROL

PITKIN STREET PUMPING STATION

EAST HARTFORD, CONN.

CONNECTICUT RIVER — CONNECTICUT

SCALE: 1/4 IN. = 1 FT.

5' 0' 5' 10'

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EAST HARTFORD, CONN.